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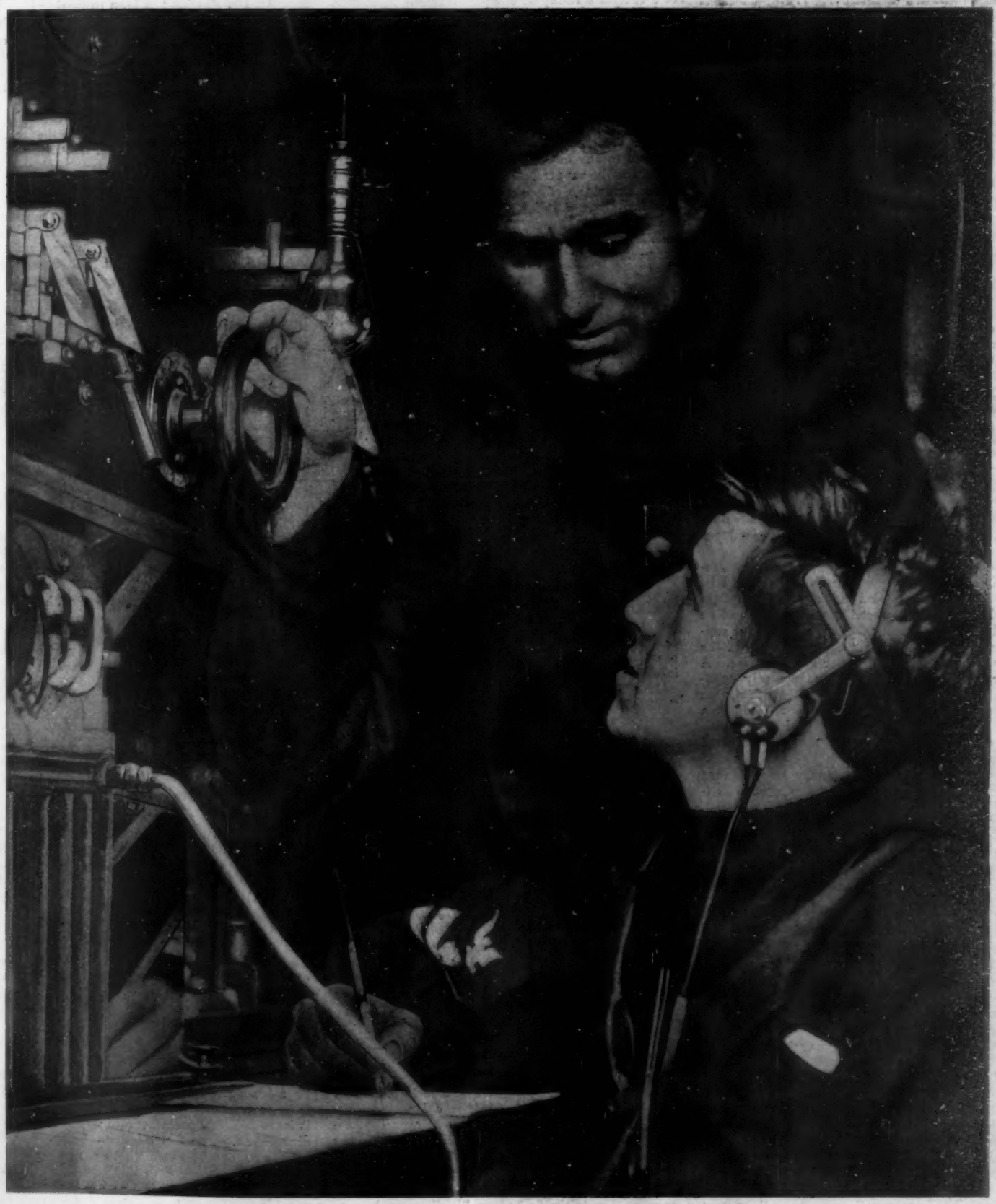

Wireless room of the U. S. revenue cutter "Gresham," life-saver of the rocky New England coast.

She depends on her wireless apparatus to keep informed of the location of wrecks, and her urgent dispatches have at times been delayed for hours by the working of amateur stations.

REGULATION OF RADIOTELEGRAPHY.—[See page 266.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Rotary Mimeograph Case

FIFTEEN years ago, at a time when the trusts were allowed to pursue the even tenor of their way, unmolested by the government and unharassed by public opinion, suits which involved exactly the same principles as the rotary mimeograph case, recently decided by the Supreme Court of the United States, were not made the subject of lengthy newspaper comment. In cases which involved restrictions upon the price of a patented article upon resale, or which related to the requirement that the article sold should be used in connection with other things bought from the patentee, the absolute right of the patentee to impose any conditions that he saw fit was recognized, and no voice was raised in protest except that of the losing defendant. All that is now to be changed if Congress, listening to Chief Justice White's dissenting opinion, decides to limit the despotic privileges hitherto enjoyed by the patentee.

The facts in the rotary mimeograph case are simple. They involve no new principle in patent law. A patented machine styled a rotary mimeograph was sold with a license restriction that it was to be used only with the stencil-paper, ink and other supplies made by the patentee. The purchaser of the machine bought ink from another supply house. A suit for patent infringement was promptly instituted against the seller of the ink, and the Supreme Court, following a long line of decisions, holds by a vote of four to three that he was liable as an infringer of the patent because he aided and abetted a proposed infringing use.

In that decision the Chief Justice sees a grave national danger. He declares that numerous articles can be brought into the monopoly of a patent, "thereby tending to subject the whole of society to a widespread and irksome monopolistic control." He sees a vast zone lying between rights under a patent and the law of the land, wherein agreements can be made whose effect will be so far reaching as to dominate and limit the rights of every one.

The four judges who concurred in the prevailing opinion saw no fatal objection in permitting the patentee of a coffee pot to stipulate that only his coffee should be used in the pot, to cite only one of countless instances that are not without the bounds of possibility. Under our law the very nature of the patent monopoly confers such a right upon the patentee. He is asked simply to disclose his invention so that the public may ultimately enjoy its use, and in return he receives an absolute monopoly for a limited term. If he sees fit to do so he may reserve the exclusive use of his invention; he may pigeonhole his patent papers and never actually build a machine, which happened in the Paper Bag cases; he may dictate particular territories in which his invention shall or shall not be used; he may impose any conditions that he sees fit, however selfish or absurd they may be.

Perhaps gigantic corporations may use the patent law to achieve the end which they are now prohibited from attaining by means of the Sherman law. Perhaps social standards have so far changed since the days when the patent law was first framed that a patent may now be used for wickedness undreamed of a century ago. Perhaps some restriction should be imposed in the interest of the public. Let us not forget, however, that the inventor, too, has his rights. He gives the world something which it never had before, something which, as in the case of the reaper, of the telegraph, of the telephone, and of the sewing machine, has increased the wealth of his country and of the world by untold millions. If an intellect which achieves such gigantic results also conceives means of controlling a market in ways perhaps not contemplated by the framers of the Constitution, let us not too rashly shackle it with burdensome restrictions.

Unquestionably abuses are possible under our present patent system. If the decision in the rotary mimeograph has served no other purpose it has at least directed the attention of Congress to the need of a careful scrutiny of our patent laws. Moreover, the resolutions recently submitted by the Inventors' Guild to the President of the United States authorizing him to appoint a committee for the purpose of investigating our patent system will probably be considered now with more than passing attention. Under our purposely liberal laws a patent may be used unmorally. But before we rush in and hastily remedy evils such as those pointed out by Chief Justice White, before we compel patentees to grant licenses to any one who may ask for them, lest the inventions be suppressed by some grasping assignee, let us study the efforts which other countries have made to strike a just balance between the inventor and the public. European countries are still experimenting in that direction, and not altogether with success.

What Martians Look Like

IT seems incredible that a scientist connected with the French Museum of Natural History should seriously concern himself with the problem of what the extremely hypothetical inhabitants of Mars must look like. Yet, according to *Le Matin*, Edmond Perrier has wasted much time and thought on that problem. As might be imagined, M. Perrier's creation is fearful and wonderful, fully as amazing, indeed, as any Martian that ever stalked in the pages of fiction.

There is not much air to breathe on Mars. Hence Perrier's Martian is endowed with a pulmonary apparatus that may be likened to a blacksmith's bellows. The attraction of gravitation of Mars is less than that of the earth; wherefore Martians are tall. Daylight is less intense on Mars; consequently, Martians must be blonde.

Nor has M. Perrier ignored the ethnological characteristics of his Martians. They are Scandinavian in type, he assures us, with blue eyes, strong noses and large ears. With gray matter, too, Martians are richly blessed, for they "know the most noble intellectual satisfactions and the suavest emotions."

If all this be true, life in Mars must indeed be "grand, intense, formidable," as Perrier says.

Making Dead Matter Live—Bastian's Work

THE old notion that life may originate from dead organic matter has long since been dismissed as an idle myth. Wherever maggots and worms appear in decaying meat or foul liquors, the living forms are now known to have originated from eggs. Pasteur and Tyndall have laid at rest all doubt upon this point.

It is upon the assumption that all bacteria arise from pre-existing bacteria, that the recent advances in the treatment and prevention of germ-diseases have been based. If these organisms ordinarily originate without the presence of similar organisms, they have managed to conceal the fact very well for forty years. For whenever we have made certain that all bacterial life has been destroyed in a given solution or other organic preparation, we have uniformly failed to obtain putrefactions or growths of any kind. Hence our faith in antiseptics and fumigations and fungicides and fly screens.

Nevertheless, the biologist who rejects the notion of spontaneous generation in the older sense, because of his faith in the principle of causality, accepts for the same reason the idea of spontaneous generation in a different sense. Many biologists are compelled to postulate the origin of living matter from non-living at some time in the history of the cosmos. For in the first place, "life" cannot be considered an ultimate fact, like energy or matter, at any rate, the scientist finds that his investigations yield more, and more satisfactory, results if he assumes that "life" is *not* an entity. In the second place, the biologist finds no satisfaction in assuming that life originated in some remote planet and came to earth under the influence of light waves; this beautiful fantasy, elaborated by the Swedish physicist Arrhenius, may be the true explanation of the origin of life upon this planet, but it does not touch the question of how life or living matter came into being in the first place. The conditions under which non-living matter "spontaneously" passes over to the living condition have not been observed; but they must have existed at some time.

Now we are from time to time informed that the spontaneous origin of life has been observed under conditions that leave no room for doubt; and for nearly forty years these announcements have come at irregular intervals from the pen of Dr. Charlton Bastian. With a patience and a zeal that are truly admirable, in the face of adverse criticism and ridicule, Dr. Bastian has been preparing little flasks of mineral solutions, sterilizing these at high temperatures, and leaving them for various periods, to be examined later for evidences of living bodies. He finds in many of these preparations bodies that are remarkably similar to many low organisms—according to his plates. And of some he even says that they grow and multiply under direct observation. Dr. Bastian's thesis is that the conditions under which the transition from non-living to living takes place are constantly present, and that therefore "life" may have originated many times in many places.

Without attempting to refute the arguments, or even to question the alleged observations, one may criticise these experiments on a very fundamental point. All living bodies known to science consist entirely or very largely of carbon compounds; in the course of the various processes that take place in practically all organisms, energy is liberated or transformed through the oxidation of some of these carbon compounds; and in all cases fluid or volatile wastes are produced, which are thrown off into the surrounding air or water. Now in the solutions prepared by Dr. Bastian there are no carbon compounds. Silicon takes the place of carbon; but although silicon forms many compounds that are analogous to certain carbon compounds, these compounds have totally different physical and chemical properties, so that the metabolism of organisms, as now known, cannot possibly take place where silicon has replaced carbon. This should settle definitely all claims for "spontaneous generation" in inorganic solutions of the kind used by Dr. Bastian.

On the other hand, if we accept the experimenter's reports on their face value (and no one has systematically contradicted the facts upon the basis of parallel experiments) we are met with the suggestion that the organic forms and processes with which we are familiar are but special manifestations of a whole series of phenomena that may with equal propriety be called "life." It is conceivable that "life" on other planets or in other solar systems may be something totally different from that upon this earth, in outward form and even in many of the intimate chemical relations. But the spontaneous silicon "organisms" of Dr. Bastian are not "fit to live" on this earth.

A New Use for Subways

PARIS may soon have its "Metro-letter," in addition to its *petit bleu*. Somebody with an imagination has suggested that the extensive system of the Metropolitan Subway be used in combination with pneumatic postal tubes. If that idea is carried out, your Parisian will simply drop his letter into a box at a subway station, have it transmitted by the Metropolitan to the subway station nearest its destination, and then forwarded by pneumatic tube. To be sure, all this means the employment of more men, both at the subway station to handle the mail and on the trains to sort the letters.

If that system is ever carried into effect, Paris will have an additional postal service, somewhat slower than the *petit bleu* of the pneumatic tube, and somewhat faster than the ordinary letter distribution. At present, the average Parisian tube letter is delivered in one and one-quarter hour after it is posted, and from four to five hours in the ordinary way. The Metro-letter could be sent in two hours at a cost less than that of a pneumatic letter and somewhat more than that of a regular letter.

Here we have a suggestion which might be well worth carrying out in American cities provided with subways. To be sure, no American city has a pneumatic tube system comparable with that of Paris or Berlin, but on the other hand a vast amount of time could be saved if the subways were used as an aid to the Post Office Department.

Engineering

Constructors of the "Nevada" and "Oklahoma."—In the SCIENTIFIC AMERICAN of March 9th a mistake was made in the names of the companies to whom have been awarded the contracts for the "Nevada" and "Oklahoma." The "Nevada" is to be built by the Fore River Shipbuilding Company and the "Oklahoma" by the New York Shipbuilding Company.

Opening of the New York Barge Canal.—State Engineer John A. Bensel recently reported that the barge canal will be ready for use in 1915. The first section of the canal to be operated will be the Champlain Canal, 81 miles long. This will be opened in 1914. It will provide for transportation of ore from Port Henry to New York Harbor. The boats to be used on this canal will be 207 feet long and have a 30-foot beam. They will draw 12 feet of water.

The Oil-Motor-driven "Fram."—When equipping the "Fram" for the expedition to the South Pole, Capt. Roald Amundsen decided upon the use of Diesel oil engines, because of the economies afforded by this type of motor. With the same capacity for the storage of fuel the oil engines gave a far greater radius of action than the common steam engines with their bulky coal fuel.

The Largest Railway Terminal in Germany.—The central station at Frankfort which has heretofore held the record for size among the railways terminals in Germany must now give place to the station at Leipsig which has just been completed. This station has been building for the last nine years, and it has cost $34,000,000, an outlay represented not so much by ornament and decoration as by enormous size for the accommodation of freight as well as passenger traffic.

New Russian Battleships.—According to a press report, Russia has decided to have two of its four 30,000-ton dreadnoughts built at Cramps' shipyard in Philadelphia, while the other two will be constructed at Vickers works at Barrow-in-Furness, England. The cost of the work to be done at Cramps will be about $6,000,000 for the two ships, and the finished battleships will cost about $12,000,000 each.

Smoke Traps in Theaters.—Smoke traps are used in the Stettin Theater, Germany, to provide against fire. These are placed on the roofing above the stage. Six traps are mounted on the vertical sides of a skylight so that a large opening is given by raising all the traps. To do this, a set of counterweights acts to work the opening cords when the weights are released, and the cables are then unrolled from drums. The opening devices are controlled from the stage, and here are placed three drums with their cables for opening the six traps at once.

Steel Belting.—After being abandoned for the last few years, endless steel belts are coming into use in Germany. According to Engineer Silberberg, the belts are very thin steel bands from 0.04 to 0.36 inch thick, and on the other hand they are very broad, from 8 to 16 inches. Such bands are made by hot rolling, then a cold drawing of the metal and special tempering, using best Swedish steel. The joint is made by the new Eloesser method, using a coupling plate which is welded to the band in connection with screw joints. It is stated that an adhesive material is applied to the pulley side of the steel belt so as to prevent slipping.

Steam Turbines in Silesia.—Recent German practice in building large steam turbine electric groups is shown in the 24,000-horse-power turbine alternator which the Allgemeine Gesellschaft built for the Chorzow electric plant in Silesia. This is a 3-phase alternator giving 6,500 volts and it runs at 1,009 revolutions per minute, working on superheated steam at 350 deg. Cent. and at 13-atmosphere pressure. The condenser plant is somewhat out of the usual order, as on account of the large amount of scale which the water deposits there had to be installed two separate condensers, one in use while the other is being cleaned. These are not mounted as usual in the basement, but on account of the frequent cleaning operations they are installed in a separate building on the ground level.

Making Rome a Seaport.—Several projects for making Rome a seaport by providing a waterway from the coast to the city have been discussed for some years past. One of these, which appears to be the most promising is to lay out a seaport of 35 foot depth near Castel Fusaro, formed by running two jetties out into the sea for some distance, as at the port of Ymuiden, Holland. From the port will lead a ship canal 15 miles long and 200 feet wide and 27 feet deep. At Rome shipping accommodations will be laid out in the river below the city, and this will be connected with the navigable part of the Tiber by a system of locks. It will cost about $15,000,000 to carry out the project. Opponents of the idea claim it will not pay, but the promoters affirm that when once the city is connected with the Mediterranean there will result a great amount of traffic.

Electricity

New Electro-plating Process.—A new method of electro-plating upon glass, porcelain and the like, which is said to give very good results, is the invention of an Italian engineer, Q. Marino, and he obtains an adherent deposit of different metals on such surfaces. In the first place, the surface of the glass is roughened in the sand blast, then it is covered with a paste made with hydrofluoric acid and a chloride or other salt of the metal which is to be deposited on the surface. Then the object is put in an electro-plating bath in order to receive a coating of the metal.

Telephoning from England to Switzerland.—We have already spoken of the new telephone cable which is laid across the channel, so as to connect France with England, this being designed on the Pupin system, so that speech is very clear and the various provinces of England can now have connection with Paris. Recent news states that connection can now be made from London to Switzerland in a practical way for the first time, so that conversations can be held between London and Geneva by way of Paris and Lyons, and between London and Basel by the way of Paris and Belfort.

Electric Synchronization of German Clocks.—Wireless telegraphy is to be utilized to synchronize all the public clocks not merely in Berlin, but throughout the whole German Empire. A new station under construction at the town of Fulda, with a tower over 300 feet high, includes a master clock, which will actuate the radio-transmitter once a minute. The importance of this project is evidenced by the fact that a census recently taken of a number of the public clocks of London by a daily newspaper showed a total variation from slow to fast of 21 minutes, and only about 3½ per cent of these timepieces gave true Greenwich time.

The Illumination of Niagara Falls.—A bill has been introduced before the New York Legislature to provide for co-operation between New York and the Province of Ontario in the matter of illuminating Niagara Falls. It will be recalled that the Falls were illuminated not long ago, and they presented a splendid spectacle. Objection has been raised against illuminating the Falls by the State, owing to the fact that it is a matter of local interest. However, it is pointed out that such an illumination is of value to the community at large, as evidenced by the number of visitors who were attracted by the previous illumination.

Electric Guides for Submarines and Aeroplanes.—Submarines, airships and the like can be steered along the path of a previously-laid electric cable in the following way: On the vessel are two wire coils placed at right angles. In the coil circuit are telephones or relays, and the cable carries a high frequency current. By comparing the sound in the two coils, the vessel can be steered so as to keep it along the line of the cable and thus avoid submarine mines or other hidden dangers. Signals can also be sent between shore and the vessel on the induction principle. For aeroplanes the cable is laid along the ground, the method being the same. In this way the aeroplane may be guided along a safe course at night or in foggy weather.

Wireless Post at Spitzbergen.—Owing to its isolation, he wireless telegraph post, which has lately been erected at Spitzbergen, presents some unusual features. It lies on the east shore of Green Harbor, and the difficult conditions of working led to the installing of a double set of machines and apparatus throughout, so that one of these can be used as a standby. In the machine room there are two separate gasoline motor dynamo sets of 30-horse-power size, and two storage batteries of 60 cells each, besides a pair of motor generators of 10 kilowatt capacity. The antenna wires are carried on metallic poles or towers 200 feet high, and the various buildings include a dwelling house, the station building proper, and also two sheds for the storage of 150 tons of gasoline each.

Telephone Service in Paris Compared With That in New York.—A French newspaper reports in an amusing way an amateur test of the time required to get a telephone connection in Paris. The test was a definite and registered one, and was suggested by the recent official test in New York city, giving six seconds as the average time. With the official timekeeper of the Aero Club, holding a chronometer, eighteen calls were put in to the four corners of Paris between 3 and 6 P. M., thus not including the lunch hour, the telephones called being in such widely varying locations as the shed of the Bayard-Clement airship, a newspaper office, a painter and a pastry cook. The result was an average of 1 minute 20 4/5 seconds—thirteen times longer than in New York. However, the director of the Paris telephones stated that official tests showed an average of only 12 seconds, and added that this time—twice as long as in New York—was due to the fact that the Paris telephone operators are on the average older than the young women employed in New York, and that most of the Paris operators are married women.

Science

The Height of Shooting Stars.—According to *Cosmos*, the mean height at which shooting stars first become visible is 81 miles. The mean height of their disappearance is about 58 miles. The mean length of their visible path is 45 miles.

The Origin of Diamonds.—Von Bolton thinks that diamonds were formed in nature by the action of metal vapors, such as iron or magnesium, on carbon dioxide. He has succeeded in making microscopic diamonds by the action of mercury vapor on carbon.

A New Star.—Prof. Errebo, of Dombass, Norway, has discovered a new star. Prof. Edward C. Pickering, of Harvard, has overhauled the Harvard negatives and he found the star upon plates recently made. On the Pickering photographs the star is of the fifth magnitude. When discovered by Errebo it was of the fourth. Its position is in the constellation Gemini, about one degree and fifty-one minutes south of the Theta Geminorum.

Frigory, the New Low Temperature Unit.—The "Association du Froid" had recently appointed a committee to submit proper suggestions for a regulation of an international unit of measurement that could be used in the refrigerating and allied industries. This committee proposed the use of the frigoric calory, i. e., the amount of cold necessary to reduce the temperature of 1 kilogramme of water by 1 deg. Cent. To prevent confusion with the calory proper, this unit of cold was named "frigory."

Soap Paper.—A chemical friend of ours, on reading the recently published science note entitled "Abolish the Common Drinking Cup," suggests that a campaign be started against the common cake of soap. About fifty years ago there was sold a form of soap for travelers, consisting of a booklet, about two inches by four inches, in which small leaves of soft paper saturated with soap were bound. Each leaf contained enough soap for one washing of the hands. It is suggested that one might profitably dispense, through a penny-in-the-slot machine, a paper towel in which is folded a sheet of soap paper, for convenient use in public lavatories.

A Gift to "Tech."—Two and one half million dollars for the Massachusetts Institute of Technology, from an anonymous donor, was the sensation that President R. C. Maclaurin sprang on the Technology corporation at its last meeting, a gift in one sum from a living man that has probably not its counterpart in the history of American education. The question of the Institute's site is now all but settled. There have been some delays, however, that made this impracticable, but it is expected that the price will be paid and the whole transaction closed in the course of a few days. The area to be purchased is almost exactly two million feet and the price of the land is $775,000. The gift is one of the largest in this era of large things. It has been given in a spirit that shows a modern business man at his very best and in a manner that cannot fail to command our admiration by the evidence that it displays of the desire to do a great thing quietly and without fuss.

Completion of the Rainey African Expedition.—Mr. Edmund Heller, who represented the Smithsonian Institution on Mr. Paul J. Rainey's African Expedition, writes from Kisumu, British East Africa, January 26th, 1912, that the expedition has been completed, but that a delay has been caused in the shipment of specimens collected by Mr. Rainey and himself, due to the lack of porters, transportation facilities, etc. The collection, which arrived at Nairobi two weeks prior to the date of his letter, has been packed and forwarded by him to the Smithsonian Institution. While waiting for a steamer from Mombasa, Mr. Heller put in a couple of months in making collections at various stations of the Uganda Railroad, including some districts not touched by the Smithsonian Expedition under Col. Roosevelt, and also about Lake Victoria Nyanza. By this means he has been able to add many species to the Smithsonian collection, as well as to finish a really complete survey of the mammals of British East Africa. He will probably spend a few weeks at the British Museum, and at the Berlin Museum, in comparing and identifying some of the specimens collected. The trip was most satisfactory in every way, and Mr. Heller estimates that the collection will rival that made by the Smithsonian African Expedition in 1909 and 1910. In all there are about 700 large mammal skins in salt, 4,000 small mammal skins, and a large number of birds and reptiles, most of them coming from regions not visited by the previous expedition, while some are from remote localities never before visited by naturalists. After the completion of his studies in Europe, Mr. Heller will return to Washington to complete his report on the mammals of British East Africa.

The Motor Liner "Selandia"

The First Large Passenger Ship to Be Equipped With Oil Engines

By F. C. Coleman

CONSIDERABLE interest has been aroused in Europe by the successful trials of the motor ship "Selandia" of the East Asiatic Company. She is the largest ship so far completed, with oil engines for propulsion, her gross registered tonnage being 4,964 tons, while the propelling engines are of 2,500 indicated horse-power at 140 revolutions per minute. The type of engine adopted is similar in all details to the "Jutlandia," a sister ship now under construction. These two vessels are 370 feet long between perpendiculars, and have a 53-foot beam, with a depth molded to the upper deck of 30 feet. The deadweight carrying capacity is 7,400 tons and the speed at sea with full cargo is 12 knots.

The passenger accommodations are elaborate, but interest centers chiefly in the propelling machinery. This consists of two main Diesel motors, each 1,250 indicated horse-power, and two auxiliary Diesel motors, each 250 horse-power.

The main motors are eight-cylinder Diesel motors, working on the four-stroke system; the number of revolutions at normal speed is 140 per minute. Reversing is effected by means of compressed air, the shaft from which the valves are moved being so arranged that it can be deplaced lengthwise after all the rods and rolls which lift the valves have been removed from the shaft by means of a crank motion. Reversing from full speed ahead to full speed astern can be executed in less than 20 seconds. When the motor has been brought into the back-gear by the reversing engine, starting is accomplished by letting air of 20-atmosphere pressure into the cylinders through the starting valve, this commencing automatically to work when the compressed air is let in.

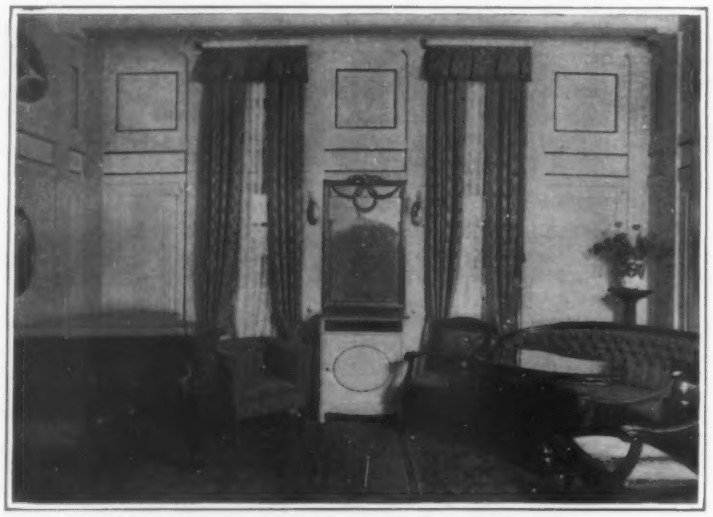
When the engine driven by the air has attained a sufficient speed, the handle is moved further, the air is shut off, the starting valves close themselves and the engine works as an ordinary Diesel motor. The work of the engine at sea is regulated by an Aspinall's governor, acting so that, with a sudden increase of the number of revolutions beyond the normal, it shuts off the supply of fuel oil and opens again only when the revolutions have dropped down to a predetermined number.

On the shaft is a small flywheel, 2 meters (6.56 feet) in diameter. This is provided with teeth which engage a worm so that by means of an electric motor the main engine can always be turned.

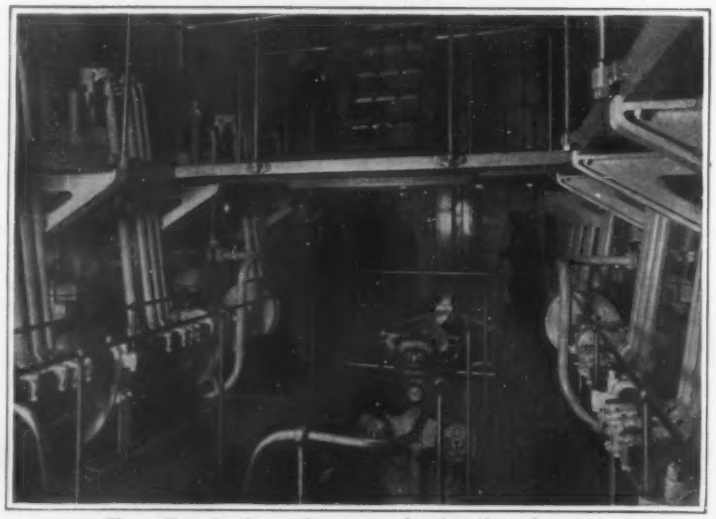
On each main engine is also an air compressor, compressing air from 20 up to 60 atmospheres, for injecting fuel oil into the cylinders. These compressors are so arranged that they can be adjusted for half or complete filling. Half filling is used when both of the pumps are working at each engine. In case one of them should be damaged, the remaining pumps will be put on complete filling and will give sufficient air for injection of fuel oil for both the main engines. As spare for the fore compression to 20 atmospheres, it is so arranged that the exhaust valve at one of the cylinders of the main engine can be removed and replaced by a delivery valve, so that the cylinder will be brought to work as a compressor, which compresses the air to 20 atmospheres. In this case the motor works with only seven cylinders. The auxiliary motors are each furnished with a dynamo and an air compressor. The latter is calculated to supply air under a pressure of 20 atmospheres, which is used for the reversing of the main motors, and also for furnishing the air compressors of the main engine with air for injection. When the ship is at sea it is intended that current should be taken from the dynamo, which is placed on the same shaft, for lighting and for working the different auxiliary apparatus, such as winches, pumps, refrigerating machinery, etc. Electrically driven lubricating pumps pump the oil, each from its own tank which is placed in the bottom of the ship, through the main bearings, thence through the crankshaft, connecting rod brasses, through the hollow-bored connecting rod to the crosshead brasses, thence through the piston rod to the top of the oil-cooled piston, and back through the piston rod, thence ejecting it over the guide. Cooling of the oil takes place on the guide faces and further cooling can be accomplished by pumping oil through a cooler formed as a surface condenser. From the two compressors of the auxiliary motors, which are carried out as triple compressors, pipes are led from the intermediate cooler with an air pressure of about 8 atmospheres to the siren, which is fitted on the mast. In the top of the casing two settling tanks are arranged, to which fuel oil can be pumped from an air-driven pump in the engine room.

There were several trials of the "Selandia" in the Sound in February. Prior to these trials there were official tests in which a speed of 12½ knots was realized with the engines running at their designed rate of 140 revolutions and 2,500 indicated horse-power. The fuel-consumption test proved that the economy was equal to the highest expectations formed from experience with Diesel engines for land purposes. The vessel will be engaged between Copenhagen and Bangkok, and is now on its maiden trip. As the return cargo will be of light description, the vessel will be able to carry sufficient oil on the homeward voyage to obviate the purchase of any oil in Europe, where the price is necessarily higher than at Singapore. Indeed, it is expected that the capacity of the double-bottom tanks will suffice for the double voyage without resorting to the bunkers which have been fitted.

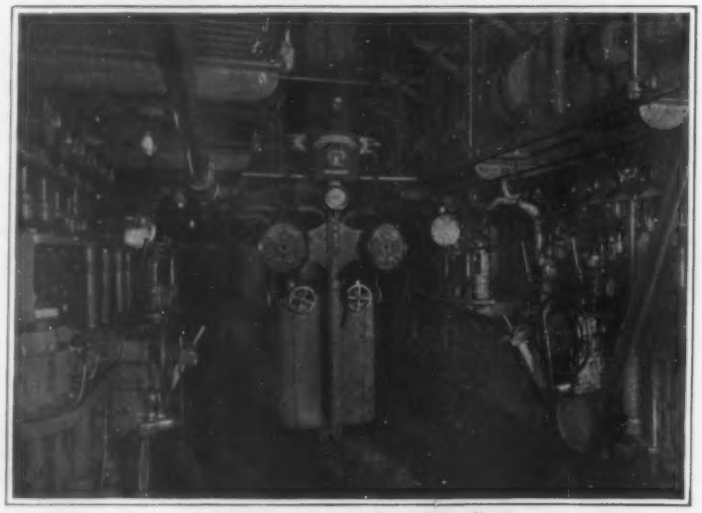
The oil-engined liner "Selandia" plying between Copenhagen and Bangkok.



The saloon looks like the drawing room of a hotel.



The gallery in the engine room, showing the valve gear.



The engine room of the "Selandia."

The Current Supplement

THE current SUPPLEMENT brings a memorial article on Lord Lister from the pen of the great English physician, Dr. W. Watson Cheyne.—A very interesting article on Poisonous Metals in Food Supplies, based on a paper read by Dr. Formenti, has been prepared for the SCIENTIFIC AMERICAN SUPPLEMENT by one of our regular contributors.—In these days of extreme civilization, proprietary rights in almost every commodity of life are regulated by law. This applies, for instance, to water, and the question has been raised as to whether the air we breathe might some time fall under the same category, inasmuch as it has recently become actual practice to furnish "sea air" to dwellings in London. But we are going a step beyond this, and even the luminiferous ether may shortly come under government control, in order to prevent its improper and objectionable use by amateurs, interfering with the serious operations of wireless stations on land and sea. This question is discussed in an article by R. A. Morton.—A paper by Charles A. Browne on the Chemistry of Raw Sugar Production gives an excellent survey of the subject treated.—A finely illustrated article by Dr. Gradenwitz describes the Bernina Railway, which establishes connection between the Engadine Pass and Italy, traversing picturesque Alpine scenery from vine-grown valleys to glacier-covered mountains.—W. J. Millard writes on Civil Engineering Work in the Tropics. His article not only makes very attractive reading, but should also prove valuable to any who may contemplate a sojourn in the tropics of America or Africa.

Amundsen's Attainment of the South Pole

Progress of Antarctic Exploration

By G. W. Littlehales, Hydrographic Office, United States Navy

THE legendary limits of the Terra Australis of ancient and medieval cartographers, whose northern coast was represented in part in the time of Ptolemy as extending eastward from Southern Africa toward China and inclosing the Indian Ocean, began to recede to the southward on the map of the world in the generation which produced Columbus, Guma, and Magellan and disclosed America, the route to the Indies, and the circumnavigation of the globe. In the latter part of the sixteenth century the number of maps representing it had noticeably lessened, and, by the end of the eighteenth century, it had faded from the minds of geographers. The voyages of Cook in the latter part of the eighteenth century constituted the first circumnavigation of the south polar regions. He reached latitudes in some parts of his circuit which have even at the present time been scarcely surpassed, and, disproving the ancient belief in a great Terra Australis Incognita extending northward of the sixtieth degree parallel of south latitude, left the state of geographical knowledge such that the maps after his time mark "Antarctic Ocean" across the regions of the South Pole.

The sum total of added knowledge in the sixty years following Cook's voyages had led to a general belief that round the South Pole was a scattered archipelago and not a continental mass, a state of geographical information that was not materially changed until the discovery by Charles Wilkes that after all there is a great Antarctic land, even if it is smaller than the land of legend. It will be remembered that, during the year 1839, after having examined many of the island groups with which the vast area of the Pacific Ocean is studded, the United States Exploring Expedition, of which Wilkes was the commander, had reached the Australian shores. On the day after Christmas in 1839 the "Vincennes," "Peacock," "Porpoise," and "Flying Fish" headed southward from Sydney, and, falling in with the land in latitude 64 degrees south and longitude 158 degrees east of Greenwich, on the 16th of January following, skirted the border of a new continent to the westward as far as longitude 97 degrees East of Greenwich. Returning to Sydney, Wilkes announced his discovery in the following words, in a report to the Secretary of the Navy, dated March 11th, 1840: "It affords me much gratification to report that we have discovered a large body of land within the Antarctic Circle, which I have named the Antarctic Continent, and refer you to the report of our cruise and accompanying charts, inclosed herewith, for full information relative thereto."

At one or two points along this coast line, the French expedition under D'Urville, at nearly the same time, confirmed the existence of the land thus reported. Wilkes' work was not only important because he traced this coast for 1,700 miles, but also on account of the geological collections made by the expedition led by him which showed that the land is formed of granite, massive sandstones, and other rocks of continental type, and further on account of the magnetic observations which were so numerous and well taken as to permit of the deduction of the earliest assigned position of the south magnetic pole.

A year later the extension of Wilkes Land to the eastward and the southward was charted by the famous British expedition under James Clark Ross, which discovered Victoria Land and the mountains of Erebus and Terror and surpassed all previous records in the Antarctic by reaching the latitude of 78 degrees.

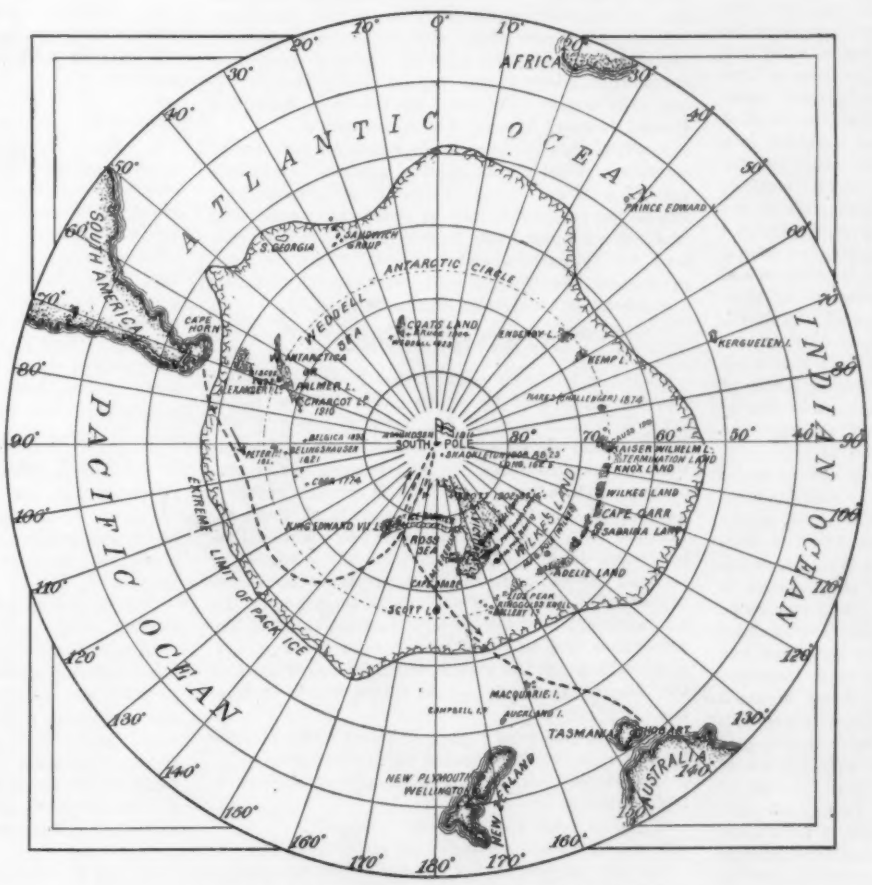
After the voyages of Wilkes and Ross, there was a long interval before serious work in the Antarctic was renewed. Until the close of the nineteenth century there was no part of the world about which less was known, and none about which so little interest was taken. This was probably due in part to its distance from the centers of wealth and thought, and in part also to its dearth of animal and vegetable life and to its unpeopled state. It is only from the scientific side that human interest can be evoked in the desolate wastes of Antarctica.

That this continent, whose present unexplored and unvisited extent is twice the area of Europe, was larger in former geological ages is scarcely to be doubted. In all probability it has been connected with Africa, South America, Australia, and New Zealand, although most likely not with all of them at the same time. This is suggested by the living and fossil floras and faunas of these lands.

At the time of the revival of Antarctic exploration in the beginning of the present century, geographical knowledge of Antarctica was of two grades: in some areas the approaches from the sea had been explored; of the rest nothing was known. Knowledge of the first grade existed only in relation to two or three parts. They were Palmer Land with its associated islands, the coast of Victoria Land with the adjacent Ross Sea, and, to a lesser extent, the coast of Wilkes Land. The rest of the continental limits of the Antarctic was known only through the interpretation of imperfectly recorded observations and the speculations arising from distant and uncertain views. The work of Krech, Gerlache, Borchgravink, and Bruce had not yet been done; the examinations of the "Belgica," the "Francais," and the "Pourquoi Pas" had not yet made known the extension of Palmer Land to the southwestward along the southern confines of the Pacific Ocean; the explorations of the German Antarctic Expedition in the "Gauss" had not yet confirmed the conclusion of Wilkes that the long coast line which he discovered in 1840 extended still farther to the westward; the Antarctic Continent had not yet been entered at any point and consequently that acquaintance with the general topography which constitutes the first essential to the scientific investigation of a country was wholly wanting.

It was the British National Antarctic Expedition of 1901 to 1904, under Capt. R. S. Scott, that first penetrated Antarctica. This expedition landed on the southwestern confines of Ross Sea, and, by its explorations, showed that the great ice barrier is in reality the front of an enormous ice field or glacier, mainly floating on the surface of an extended bay or sea, and fed by glaciers coming down from the elevated land on the western side and probably also on the eastern. Scott traveled southward up the western margin of the ice field 400 miles to a point in latitude 82 deg. 16 min. 33 sec. south. He also climbed from his headquarters on MacMurdo Sound to the summit of the high table land to the westward.

Shackelton's expedition of 1907 to 1909 penetrated at the same place that Scott entered, and traveled up the western border of the ice field along the route which had been pursued by his predecessor until he reached a great glacier, named Beardmore Glacier, coming down from the high lands to the westward. He followed up this glacier to the summit of the plateau and then continued to the southward until he reached a point in latitude 88 deg. 23 min. south, only 97 miles from the South Pole. At this point the elevation was 10,000 feet above the level of the sea. While this journey to the southward was in progress, another party of the expedition climbed Mt. Erebus, and a third party reached the south magnetic pole and located it, in 72 deg. 25 min. south, and 155 deg. 16 min. east, in a position 40 miles distant from the position deduced from the surrounding magnetic observations of the expedition under Scott. The observations in either case were not sufficient, however, to warrant drawing a conclusion as to the actual change in the position of the magnetic pole between 1903 and 1909.



THE PROGRESS OF ANTARCTIC EXPLORATION

Five expeditions were sent to the Antarctic during the past year, for the purpose of reaching the South Pole, or for the exploration of the Antarctic Continent, or both. The first is the British Expedition under the command of Capt. R. F. Scott, who was the leader of the British National Antarctic Expedition of 1901 to 1904. He sailed from Port Chalmers, New Zealand, in his ship, the "Terra Nova," November 29th, 1910. He made a successful landing at a point near his former situation in MacMurdo Sound, and continued to be engaged in exploration to the southward.

A German expedition under Lieut. Wilhelm Filchner left early in the year 1911, intending to make a landing somewhere on the shore of the Weddell Sea—perhaps on Coats Land, on the opposite side of the Antarctic Continent from Capt. Scott's headquarters. No reports have yet been received from him.

A Japanese expedition started for the Antarctic, intending to make a landing upon King Edward VII. Land. Before reaching its projected landing place, however, this expedition suffered a series of mishaps, the chief of which was the loss of nearly all the dogs upon which reliance had been placed for transportation.

Near the close of the year 1911, another expedition started for its field of exploration in the Antarctic. This is the Australian expedition under the leadership of Dr. Douglas Mawson, geologist of the Shackelton expedition. The "Aurora," a barkentine of 580 tons with auxiliary steam-propulsion in which the expedition sailed, has recently returned to Australia bringing the report that two separate parties have been landed on those parts of Wilkes Land known respectively as Adelie Land and Termination Land.

Capt. Roald Amundsen, the discoverer of the Northwest Passage, left Norway in June, 1910, in the "Fram," seemingly with the intention of sailing around Cape Horn and through the Pacific Ocean and thence through Bering Sea into the Arctic Ocean. Upon rounding Cape Horn, however, he sailed to the westward across the South Pacific, and made a landing at Whale Bay on the ice sheet covering Ross Sea. This place is

(Concluded on page 277.)

Curbing the Wireless Meddler

Regulation of Radiotelegraphy

By Robert A. Morton, Jr.

WHEREAS the Morse telegraph connects two or more definite spots, the wireless station, on the contrary, throws off in all directions wave-messages that can be received at any and all stations within a circle, the diameter of which varies with the power of the apparatus. The results are loss of secrecy, for any person may "tap" the ether and relieve it of messages, official or commercial, public or private; also interference, accidental or intentional, for only one station can operate its highest efficiency at one time in any one vicinity. It appeared inevitable, despite prospects of future improvements, that the construction of thousands of wireless stations of the navies, of commercial companies, of experimenters, and of amateurs, would shortly produce an "ethereal" chaos unless science should overcome the difficulties, or unless the indiscriminate building of stations should be prohibited, and the operation of all systems regulated by law.

Why the Government Wants Regulation.

Some degree of government regulation appealed especially to naval authorities. It increased immensely the possibilities in naval strategy of cruising, scouting, and fighting, and also in the handling of the fleets in time of peace. Within a few years practically every vessel of our navy, including colliers, tugs, and the boats of the Revenue Cutter Service, had been equipped with wireless apparatus, and to communicate with these the Navy Department erected a chain of coastal stations, reaching from Maine to Alaska. These stations not only controlled the vessels of the navy, but performed important maritime services—the sending of official weather reports, storm warnings, news of derelicts, and other hydrographic information of value to our shipping. A very important part of their work became the control of the revenue cutters while on duty at sea. Reports of wrecks or distress signals were forwarded to these coastwise patrols, and the resulting saving of life and property has been one of the most creditable accomplishments of our naval wireless system. The revenue cutter "Gresham" has a record of over three score lives saved, and more than forty vessels towed from dangerous positions when out of control. One day in the winter of 1910 the "Gresham" saved twenty lives from five sinking schooners along the New England coast, a feat which would have been impossible without her wireless equipment. The naval system in these and in other ways served both naval and public interests. When, therefore, a host of rival commercial companies, more than one of doubtful parentage and mission, planted their stations at convenient stock-selling locations, often within a stone's throw of naval stations, and proceeded to congest the atmosphere with much miscellaneous and irrelevant conversation, government regulation became a popular theme in official circles. At this moment, when the press is full of "wireless finance" disclosures, and when some half dozen promoters who controlled practically all important American wireless interests are residing at Atlanta at the expense of the government, a discussion of the exploitation of the commercial field is unnecessary. With all the gross mismanagement, however, these concerns performed real service in numerous cases of emergency at sea. The spectacular rescues of one corporation, for example, have almost overshadowed the fact, more patent perhaps to the stockholders, that the company, capitalized at twenty million dollars, has, since the government investigation, discovered a somewhat doubtful list of assets that total five hundred thousand.

The Interference of 200,000 Amateurs.

One result of the government's *laissez-faire* policy is the amateur wireless operator, an individual that made his appearance when the first naval stations were built. At the present date he is said to number approximately 200,000. For the most part he is a school boy eager to explore the latest scientific mystery, to make his instruments or buy them from a dozen firms that make it their business to supply him, to memorize the wireless codes, from a local wireless club and system, and, last but not least, to outdo the regular stations in long distance work; all of which would be satisfactory were it not for two facts; the constitution of the ether, and the importance of the naval and commercial systems in safeguarding life and property on the sea. Unfortunately the amateur thrives along the coast and near the regular stations, and here he holds a strategic position, for he can prevent at will the operation of any other station in his neighborhood or within a distance of perhaps fifty miles. In some instances his interference has been malicious, as naval records show; in most cases it has been merely incidental to his wireless intercourse with his friends. Nevertheless, he has interfered with distress signals, and official dispatches, and has sent at least one fake dispatch—that in 1910 when a revenue cutter went to sea in a storm to look for a shipwreck that had its origin at an amateur wireless station.

Experimental stations conducted by responsible persons naturally fall in a different class from the amateur. Such stations are necessary and can be conducted without increasing interference difficulties. A private school at Newport, R. I., for example, has a powerful experimental station in charge of a government licensed operator, the first station of its kind to be so managed. The vital seriousness of the presence of the amateur lies partly in the fact that, however the naval and commercial interests may improve operating methods, the amateur operator having no co-operative responsibility, cannot be included in the improved system. He must always be a disturbing element however innocent his intentions.

A still further stimulus to the desire for government regulation outside of purely domestic arguments arrived with the events of the Russo-Japanese war. Briefly the proposition may be stated thus: radiotelegraphy is of incalculable importance in time of war, both for belligerents and neutrals. Therefore, each government must for its self-defense control all public and private establishments within its territory.

The Need of Regulation.

To-day it is clearly evident that however the past may have benefited by a *laissez-faire* policy, to-day some kind of responsible regulation is essential, and this not primarily for official interest in warfare, but as well for common sense domestic reasons. It is true that scientific advance has brought certain improved methods of operation. On the other hand, these advantages have been more than offset by additional interference, due to the rapid increase in the number of stations, and to the increased power and range of the instruments. The use of wireless by the army, the recent successful adaptations to aeroplanes, balloons, and submarines, indicate conclusively that the new telegraph will direct the next international struggle—that the "Message to Garcia" of the future will go by wireless.

Now, the policy of the government toward radiotelegraphy is limited to one of three alternatives:

1. Natural competitive growth without federal interference.
2. Government ownership and monopoly.
3. Government regulation and supervision.

The first proposition has the support of the commercial interests that must be affected by technical legislation requiring changes in wireless equipment, for a satisfactory system cannot be devised without very general changes in locations of stations and forms of apparatus at considerable expense. For reasons, however, already discussed, certain technical reforms must be instituted. The second proposition, in the opinion of the writer, offers the only satisfactory and permanent solution of the whole question of radiotelegraphy, for it should now be obvious that this activity has all the ear marks of a natural monopoly, and a natural government monopoly, and must finally become such. At the present time government ownership of public utilities is not a popular subject. The present method of attack therefore lies in the last alternative —government regulation and supervision.

In a bill "To Regulate Radio-Communication" now before the Senate, the matter of general legislation is met fairly satisfactorily. It provides that all American stations, private and commercial, be licensed and placed in charge of licensed operators; penalties are prescribed for interference with distress signals, or with naval or military dispatches, and for the sending of fraudulent messages. Failure to comply with these requirements would mean forfeiture of apparatus, and in some instances fines and imprisonment. The needs of general supervision are fairly well met, but the arbitrary and official tone and wording of the act is highly objectionable. Furthermore, the act destroys its usefulness by announcing a set of technical regulations for the operation of all stations. These rules require certain classes of stations to use certain wave lengths, and also waves of a certain technical form, difficult enough to obtain even in the laboratory. Ship stations must cut down power when within certain distances of *naval and military stations*, and commercial stations can operate only during the second half of every hour, and then only on condition that *naval or military stations* have no "important" business to transact.

Four principal objections operate against this bill:

1. The wording and tone of the general provisions leave no room for doubt that the bill was designed by naval officers to subordinate commercial and private interests to naval and military interests.

2. The power given to the Secretary of Commerce and Labor to grant or withhold licenses at his discretion is excessive, and might lead to gross abuses. To suppose that one person in a short term of office could gain a comprehensive knowledge of so large a subject —one which he must handle as a dictator—is absurd. The plan is impracticable and impossible.

3. The proposed technical regulations are arbitrary, unproved, and purely experimental. Their adoption would lead to endless confusion and a tangle that would take more than one bill to rectify.

4. The proposed regulations would force immediate expensive changes in wireless telegraph apparatus, and would probably bankrupt all but one or two commercial companies whose foreign credit might save them. The act is practically confiscatory.

Little danger is there that this act will become a law. It is valuable, however, as an illustration of the extremes to which hasty ill-considered legislation can go when pushed by a single interest. Radiotelegraphy is in its infancy and the facts must be met in a broad non-partisan spirit. A representative commission in conference can settle these questions with minimum interference to legitimate interests and at the same time with maximum benefits to all concerned.

* This is an abstract of a paper published in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

The Linden Museum at Stuttgart

THANKS to the untiring efforts of the late Count Karl von Linden, the city of Stuttgart, Germany, has a geographical and ethnological museum which is remarkable for the extent and character of its collections.

Originally intended as a museum of a rather commercial character, to acquaint Germans with the customs and products of foreign countries, the institution has broadened considerably and become more scientific in character. Von Linden recognized that the time was not far distant when most of the savage peoples of the world would cease to follow the ways of their ancestors, and that, under the influence of civilization, many an old art and handicraft would be forever lost. It was imperative for some scientifically organized and conducted museum to preserve the records of primitive civilizations.

Thanks to his personal efforts, he rapidly collected a large number of costumes, carvings, weapons, of savage workmanship, and a vast amount of other exceedingly valuable ethnographic material. So rapidly did this collection grow that in 1910 it was necessary to erect a special building in Stuttgart, which in dimensions and beauty of architecture compares favorably with the largest museums of the kind in the world. The new museum was officially opened on May 28th, 1911. Unfortunately, von Linden did not live to see that event. He died on January 15th, 1910.

In the von Linden collections will be found specimens from every country in the world. Africa, Asia, North and South America, Polynesia, Australia—all are represented by countless objects of great interest, such as weapons, carvings, head-dresses, shields, canoes, idols and the like. This material was contributed for the most part by government officials, missionaries and travelers. Some divisions are more complete than others. Moreover, there are some duplicates. For the purpose of completing the imperfect collections, the museum is prepared to exchange its duplicates for objects which it does not already possess. Thus, while the American Indian of the Far West is well represented, the museum feels the need of specimens from Northwestern Canada, Mexico, Central America and South America. Collectors and museum directors who desire to enter into exchange relations with the Linden Museum may address the director of the Museum für Länder- u. Völkerkunde (Linden Museum), Stuttgart, Germany.

Morning and Evening Stars for 1912

Positions of the Sun and Planets for the Coming Year

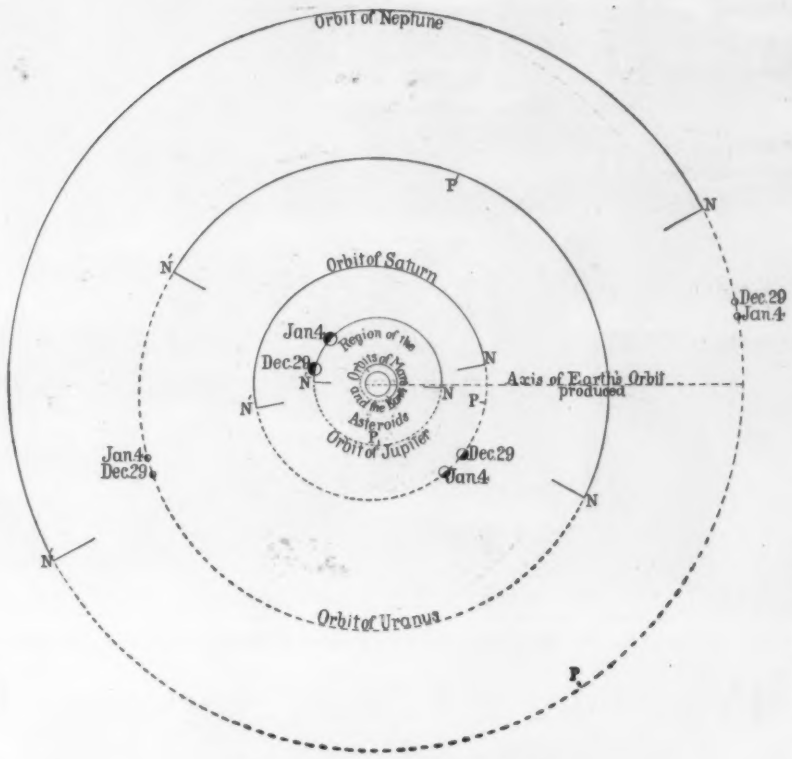
By Prof. Frederic R. Honey, Trinity College

THE return of the seasons from year to year shows no changes in the stars which are fixed in the heavens, and which in orderly course present to the observer the same aspects when the passage of time brings around another year. In reviewing the annual variations of our solar system in those changes of the planets which are popularly styled "morning and evening stars," it is worthy to note the situation of our great primary and his satellites, as that of isolation in space. Some idea of this isolation may be apprehended by recalling the fact that light from Alpha Centauri (the nearest fixed star) moving at the rate of over 186,000 miles a second, takes about four and one-third years to reach our system. Owing to the vast distance expressed in "light years" (i. e., the distance traversed by light in one year) the stars are for all practical purposes "fixed" to the observer not equipped with the means of detecting those minute changes due to parallax, and thus are always found in the same place in the heavens. In contrast to this fixity are the wandering habits of the seven planets and the seven hundred asteroids, which are continually changing their positions.

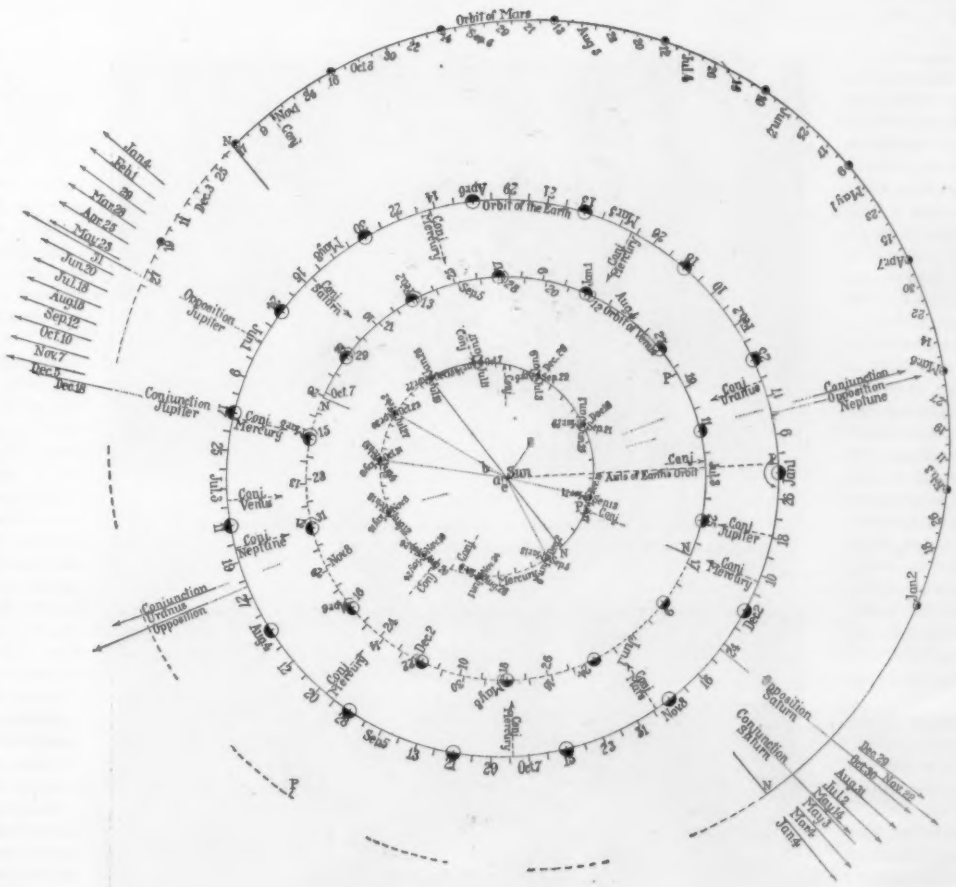
The Sun and Planets.

In the revolutions of the planets around our sun, which, like other so-called fixed stars, has a rapid motion in space, attention is called to the marked discrepancy in their relative sizes, and the significance of the earth in relation to the whole. Jupiter and Saturn, together containing over 92 per cent of the entire mass, leave about 7 per cent to be divided between Uranus and Neptune, with a fraction of 1 per cent for the four terrestrial planets and the asteroids.

In the accompanying plots the orbits are represented by their projections on the plane of the ecliptic; and on account of the limited dimensions of the drawings the deviation from the circle in some cases is scarcely appreciable. The planes of the orbits are inclined at small angles to the ecliptic, intersecting it at the lines of nodes *N N'*. If this page be placed in a horizontal position and regarded as the plane of the ecliptic, that part of space which is nearer the reader will be referred to as above, and that on the other side will be described as below that plane. This is obviously a convention for convenience of reference. The point *N* where the planet passes from the space below to that above is called the ascending, and *N'* is the descending node. The full line represents that part of the orbit which is above the ecliptic. *P* is perihelion, or point of nearest approach to the sun.



Plot 1.—Orbits of the major planets.



Plot 2.—Orbits of the terrestrial planets.

The Terrestrial Planets.—The Earth.

The earth, the largest of the terrestrial planets, has a mean velocity in its orbit of about 18½ miles per second, which is increased at perihelion in January and diminished at aphelion in July. It moves a distance of nearly 1.5 million miles daily. The axis is inclined to the plane of the ecliptic at an angle of about 66½ degrees; but its direction when projected on that plane is not parallel to the axis of the orbit. The eccentricity of the orbit is 1/60; thus the linear eccentricity (e) or actual distance between the sun's center and *a*, the center of the orbit, is a little over 1½ million miles; as a consequence, the earth's distance from the sun in January is a little over three million miles less than in July. The positions of the earth and of all the terrestrial planets are shown in the drawing at intervals of four days at Greenwich noon; and intermediate positions and dates are easily supplied by subdivision. The earth at a distance of 92.9 million miles from the sun rotates on its axis in the direction of the arrow (see position of January 1st). The sun is obviously above the horizon to an observer situated on the illuminated surface, and below the horizon to one who is on the unilluminated surface. To an observer who is on the line which separates the surfaces, the sun is either rising or setting. If this is clearly understood, there will be little difficulty in determining, from an inspection of the plot, the planets which rise before and those which set after the sun, i. e., the morning and evening stars for any day of the year.

Mercury.

In a plot which is limited to the dimensions of this page, the great eccentricity of Mercury's orbit illustrates more clearly than that of any other terrestrial or major planets the laws which govern all the planetary motions. The orbit is inclined at an angle of 7 degrees to the plane of the ecliptic, intersecting it at the line of nodes *N N'*. The eccentricity is a little over 1/5—making the linear eccentricity 7.4 million miles from the sun to *b*, the center of the orbit. Mercury makes the perihelion passage at the rate of 35 miles a second, at a distance of 28.6 million miles from the sun; this distance being increased to 43.4 million miles at aphelion, where the planet's velocity is reduced to 23 miles a second. Thus the first two of Kepler's laws are clearly illustrated: 1st, the planet's orbit is an ellipse; 2nd, the planet's radius vector sweeps out equal areas in equal times. The area of the triangle with the sun as a vertex, and a base equal to that part of the orbit traversed between the dates September 5th and September 13th, is equal to the area of the triangle with the same vertex, and a base equal to that part of the orbit included between the dates October 23rd and October 31st. Mercury's revolution is completed in very nearly 88 days (87.97); and on account of the rapid changes in the velocity of the planet, its position is shown for every second day. The reading of the date is adjusted to the position of the earth, to avoid turning the head whenever it is required to determine whether Mercury is morning or evening star. Four dates are attached to each position, because the planet makes more than four revolutions during the year.

Venus.

The orbit, which differs very little from a circle, is inclined at an angle of 3.4 degrees. Its eccentricity, the least of all the orbits, making the linear eccentricity less than half a million miles, brings the center very near the sun's surface, and is indistinguishable in the plot. In order to avoid confusion, only a part of the line of nodes *N N'* is shown. On account of the small eccentricity, the planet moves with a nearly uniform velocity of 21.9 miles a second, at a mean distance of 67.2 mil-

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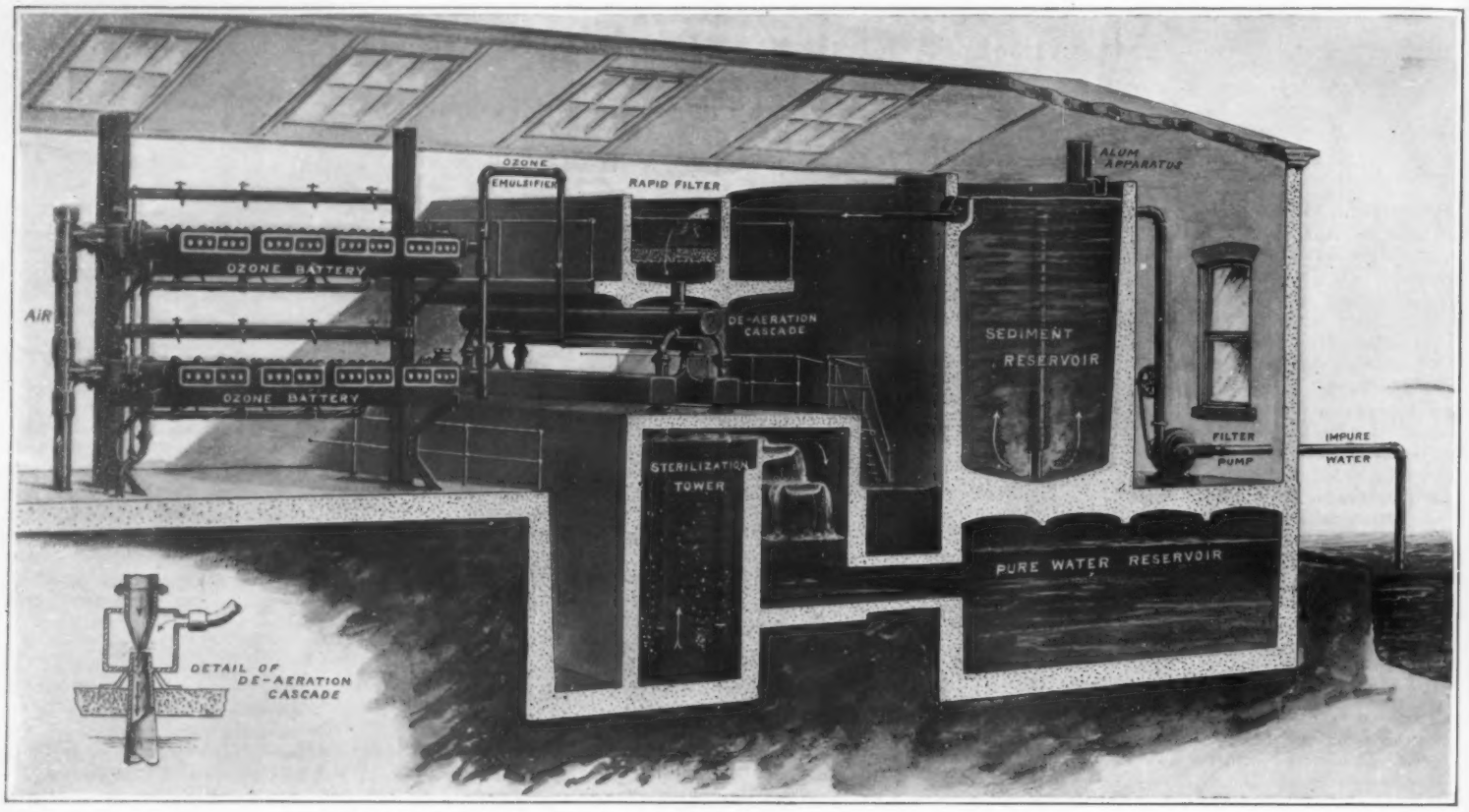


Sectional view of the St. Petersburg sterilizing plant, showing arrangement of the apparatus.

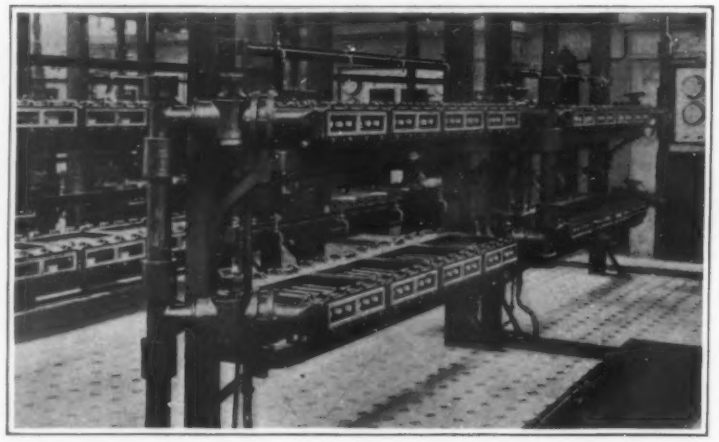
St. Petersburg's Water Sterilizing Plant

Suppressing Typhus and Cholera Epidemics With Ozone

By C. Van Langendonck

THE city of St. Petersburg has recently installed a large ozone water-sterilizing plant, with a view to stopping typhus, which is always endemic and to suppressing the cholera endemics, which have recurred annually for some years.

The new ozone-sterilizing plant has been added to one of the municipality waterworks, which pumps the ordinary Neva River water direct into the municipal mains. The daily capacity of this waterworks is about 14,000,000 gallons. Before the ozoning process, the water is subjected to clarification and rapid filtration in order to remove the impurities in suspension resulting from the excessive pollution which it undergoes during the period when the ice breaks up. The water-sterilizing plant consists essentially of two main parts, the filtration plant and the ozone sterilizing plant. The water is pumped direct from the Neva River into the clarifying reservoirs, a solution of alum of suitable concentration being added in accordance with the well-known American system. The clarifying reservoirs are eight in number; they are connected by means of pipes to the rapid filters, thirty-eight in number. These filters are of the Howatson type, somewhat similar to the American Jewell filters, but in place of fine filter sand specially prepared flint is employed. The rate of filtration is about 92 gallons per square foot per hour. The filters are cleaned in the usual manner, by back-rinsing with filtered water, the flint being stirred by suitable gear. The filtered water is taken direct to the sterilizing towers through a ring-main, a small part being diverted into a reservoir, where it is collected for rinsing the filters. In contradistinction to slowly-percolating sand filters, the duty of the rapid filters is not to stop bacteria, but merely to retain the impurities and coloring matter in suspension in the impure water. The actual ozone plant is connected to the filtration plant and also consists of two parts, viz., the ozone battery and the sterilizing towers. The former consists of 128 elements, while the latter comprise five towers, of which one is a spare. The ozone battery is built up of Siemens & Halske ozone tube elements, in which the oxygen in the air is converted into ozone by high-tension silent discharges. The brush discharges take place between cylindrical poles of aluminium and glass. The concentration of ozone is determined to suit the method of working of the towers, at the comparatively high value of 0.07. Before entering the ozone battery, the air passes through a cooling apparatus in which it is brought to the degree of dryness necessary for the production of ozone. The movement of air through the ozone battery and the pipes connecting it with the towers is effected by the so-called emulsifiers which are fitted in the towers. These Otto system emulsifiers, or water-jet air-pumps, suck the ozonized air out of the ozone battery, and eject it, mixed with the water, into the sterilizing towers. The absorption of ozone and simultaneous sterilizing of the water is effected partly in the emulsifiers and partly in the towers, from the bottom of which the gas rises in a very finely divided state, and hence in very intimate contact with the water. The latter is discharged from the towers over de-aerating cascades into a discharge pipe, which conveys it to the pure-water reservoirs, whence it reaches the high-pressure pumps, which force it into the municipal mains.



The room in which ozone is produced by high-tension silent discharges between cylindrical poles of aluminium and glass.

Tanks in which the water is rapidly filtered before passing through the "de-aeration cascade."

ST. PETERSBURG'S WATER STERILIZING PLANT

In the power house two 150-horse-power steam engines direct connected to three-phase generators have been provided for running the plant. Three high-frequency rotary transformers raise the periodicity at which the current is generated to 500 cycles per second, after which the current is stepped up, by static transformers, to a pressure of about 7,000 volts, for the ozone battery.

The dirty water of the Neva River is converted into clear, pure and healthy drinking water, the bacteriological index of which is very low, and the pathogenic germs of cholera, typhus, etc., are entirely absent. The running costs amount to about 1 cent per 1,000 gallons, of which less than half is for the ozonizing process.

Thawing a Six-inch Water Main

How a Brine-covered Pipe-line Was Freed of Ice by Electricity

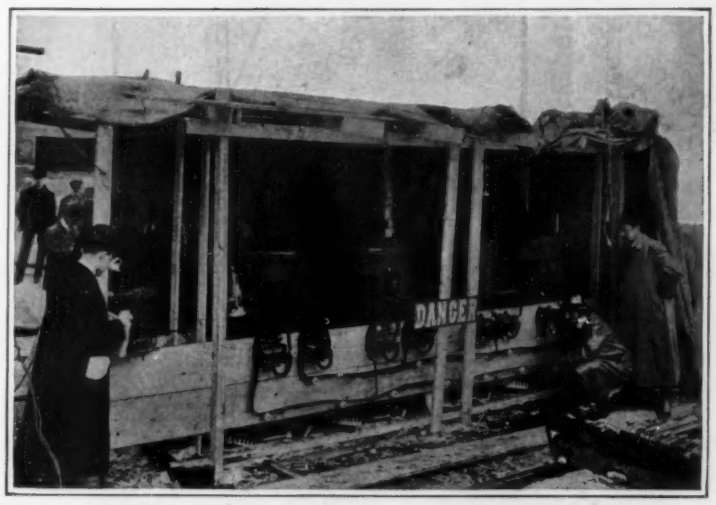
A LITTLE over a thousand feet from the foot of East 141st Street, New York city, lies North Brother Island, on which is situated the Riverside Hospital. The water supply of this hospital is brought over from the main land through a six-inch pipe that is laid along the bed of the river. At the island end this water main is so near the surface as to be uncovered at low tide. During the excessively cold weather of this winter, ice formed in the exposed part of the water main and gradually extended toward the Bronx side for a distance estimated at about 160 feet. This completely shut off the water supply of the hospital, and it was necessary to carry water on the little ferry "Riverside" that plies between the island and the mainland. A government water boat was also pressed into service, but it was difficult to meet the demands of the hospital, and affairs became so serious that many of the patients had to be removed. Finally, after these conditions had existed for over a month it was decided to melt out the ice in the main by electricity.

It is a very common thing to free ice-clogged service pipes in this way. A heavy current is forced through the pipe such that heat is generated by its resistance to the flow. But heretofore the pipes have all been situated on land, and hence the radiation of heat from the pipes was comparatively slight. The main under the river, however, offered peculiar difficulties. The temperature of the river water, which was constantly sweeping back and forth over the pipe, was actually below freezing point of pure water, for sea water will not freeze until lowered to 27 deg. Fahr. Furthermore the radiating surface on the outside of the pipes was considerably greater than that of the inside wall surface. With the main constantly cooled by a cold brine it was necessary to use thirty-six times as much current as would have been required in a pipe buried in earth.

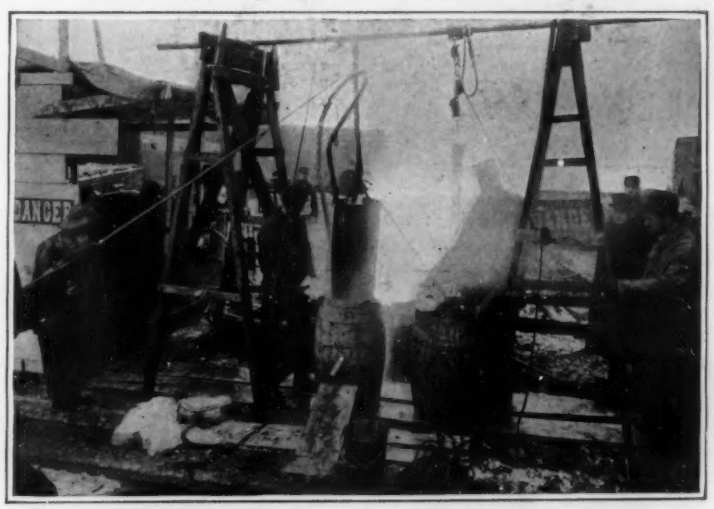
Another difficulty presented itself. The pipe sections were calked at the joints with lead. Now, lead offers twice as much resistance to the flow of electricity as does iron, and as a consequence there was danger of melting out the packing at the joints, which would render the pipe line useless and would require taking it up and relaying it.

The task of melting the ice core was undertaken by the New York Edison Co., and was begun on Monday, the 4th of March. A temporary sub-station was established on the shore at 141st Street, and here four 100-kilowatt transformers were installed to drop the current from 2,000 volts to 200 volts. Water rheostats were also provided. The frozen main was disconnected at each end and current was applied to the Bronx end, and the circuit was completed by connecting the North Brother Island end to one of the Edison cables running across the river. This work was completed by 10:15 on the following morning, and the current was turned on. At first 800 amperes were used at a pressure of 200 volts. Then this was increased to 1,000 amperes. At the same time pumps were installed and a pressure of 80 pounds was maintained in the main. On Friday, the 8th, the current was increased to 1,300 amperes, and water pressure was applied at the Bronx end, while the North Brother Island end of the pipe was left open. Soon steam began to issue from the pipe, and hopes were raised that the ice blockade was gradually yielding to the heat generated by the current. But soon the flow of vapor ceased. On the following morning the current was raised to 1,500 amperes and 400 volts, the sub-station having been enlarged in the meantime by the addition of two 100-kilowatt transformers. When this immense flow of electricity failed to dislodge the ice an experiment was tried to see whether the lead calking would stand an increased flow of current. Two sections of 6-inch iron pipe were connected in the usual manner, and the joint was calked with lead. The pipe was filled with ice and the ends were then closed with iron caps. This testing pipe was lowered into the river, where it was allowed to remain until conditions would be exactly similar to those in the water main. Then a current of 1,500 amperes was passed through it, and it was found that it took twelve hours to melt the ice in it. As the lead calking showed no signs of giving way under this treatment, it was decided to raise the current through the main to 1,800 amperes. This was done on Sunday evening, and finally at 6:20 on Tuesday morning, after the current had been applied for thirty-six hours, the ice pack gave way. Thus ended successfully the biggest pipe thawing job on record.

Electrical connections to the water main.



The battery of 100-kilowatt transformers.



The water rheostats for controlling the current.

THAWING A SIX-INCH WATER MAIN WITH ELECTRICITY.

Some idea of the enormous current used may be had when we consider that the same current could have been used to supply a small town with light continuously day and night. Had the current been passed through the delicate filaments of incandescent lamps instead of the six-inch water main it would have lighted nearly 13,000 16-candle-power lamps of the carbon type, or nearly 29,000 of the common 25-watt tungsten lamps.

Once before the North Brother Island water main froze. That was in 1892. Efforts to dislodge the ice were fruitless, and finally it was necessary to raise the pipe line, thaw it out and then relay it.

Another Arithmetical "Nut"

A HUNGRY traveler in Africa came across three simple-minded savages as they were about to sit down for their noon-day meal. He asked and received permission to share it with them, promising to pay them handsomely for the food.

Savage No. 1 contributed 6 cocoanuts to the meal; savage No. 2 contributed 10, while savage No. 3, a large man who was very hungry, added 14 to the pile, making 30 cocoanuts in all for the four men—three savages and the traveler.

The cocoanuts were shelled, and the savage hosts being courteous, each ate only his fair and equal share—the traveler, though still hungry, thus eating only his equal share. Rising after the meal and thanking his hosts, he handed them 30 coins to be divided among them as payment.

Immediately there arose a terrible wrangle as to the division of the money. The first savage who had contributed but 6 cocoanuts insisted on the coins being divided in three equal parts, because three people had supplied a meal for which the fourth paid—therefore an equal division in thirds, he contended, was the only logical one. The second savage said that as the first savage had eaten more than he had contributed, he had no share in the spoils at all, and that the third savage and he, the second, should divide the spoils equally between them, as they alone had given the traveler his meal.

The third man, who had contributed 14, said that the proper principle was obvious: As each had contributed cocoanuts to a total of 30, and that as there were 30 coins, each should receive a coin for each cocoanut contributed.

No decision being reached, they agreed to leave it to the stranger and abide by his decision, which he guaranteed to be a just one. And on his announcing it, so simple was his reasoning that all agreed, though none got what he had asked for.

What was the just decision?

This apparently simple problem was answered by the stranger in this way: The first savage was to receive nothing at all, the second savage 7 coins, and the third savage 23 coins. Immediately three swords were raised, two to run him through, and one to defend him. But there was no fight. His logic won him his life. He said:

"There were thirty nuts, of which four people ate equal shares, or 7½ nuts, which is 30/4. No. 1 contributed 6 nuts, or 24/4, yet he ate 30/4, thus going in debt for 6/4 nuts. No. 2 contributed 10 nuts, or 40/4, ate 30/4, and thus contributed 10/4 nuts to the supply from which I ate. No. 3 contributed 14 nuts, or 56/4, ate 30/4, thus contributing 26/4 of the supply from which I ate. But I, like you, ate only 30/4. The sum of the contributions of man No. 1 and man No. 2 was 36/4. The remaining 6/4 you both contributed to man No. 1's dinner. Now I did not pay any of you to feed any of you—I paid you to feed *me*. As man No. 2 contributed 3/4 of a nut to man No. 1 and 7/4 to me, and as man No. 3 contributed 3/4 to man No. 1 and 23/4 to me, I say that man No. 1 is in debt to each of you for 3/4 of a nut, and hence one of you should get 7, the other 23 coins."

Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

The Use and Misuse of Tools.—I

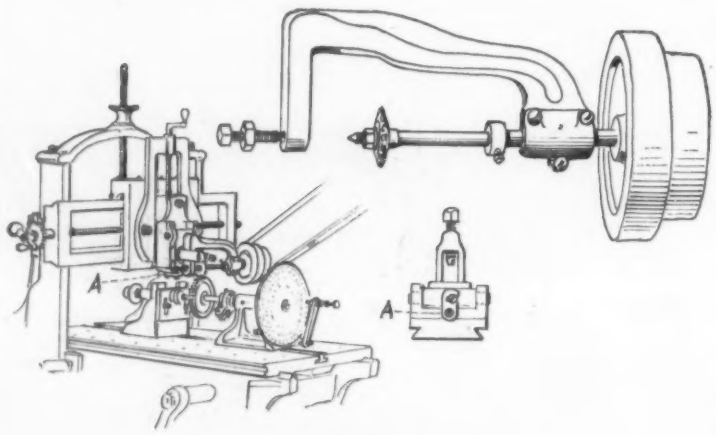
By C. H. Claudy

TINKERING with tools is a national habit. Most men have a few tools of one kind or another about the house. Few have had any training in their use, and so, very often, either misuse them or handle them to less effect than if they observed a few simple rules, deduced by centuries of carpenters and wood-workers.

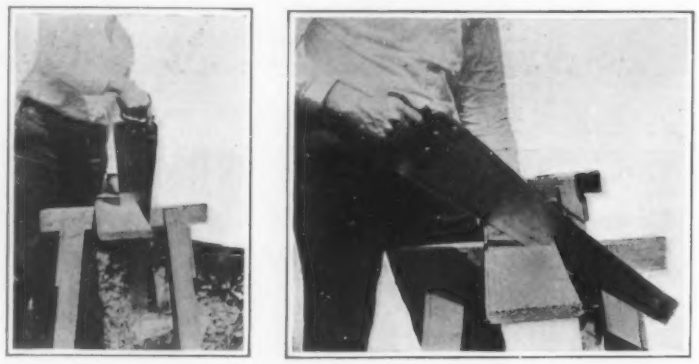
The simple operation of sawing a board in two is a case in point. Like everything else to be done with tools, there is a right way and a wrong way, as plainly illustrated in the photographs. The man whose crosscut saw is at an angle of about forty-five degrees with his work is sawing in the proper manner, while he whose saw is perpendicular is taking a great deal more strength for his work than he should take and going about the work in the very best way to saw it crooked and to make jagged splinters! Note how contorted the wrist in the picture is, while with the saw at the proper angle, the saw, handle, hand and forearm become mechanically one piece and the sawing is done entirely with the large biceps and triceps of the upper arm. Sawing straight up and down tends to going crooked, because less bearing surface is provided for the saw in the saw cut. With the saw held on a slant, there is more saw in the saw cut, consequently the more easily it will stay "true." The perpendicular saw means splinters, because most boards are cut parallel with the grain of the log from which they were made. A slanting saw pulls and pushes the last few fibers so that they receive some support from their neighbors, while the perpendicular saw pushes them forth from the board, making an ugly splinter beneath the work.

Perhaps the plane is more often misused than the saw. All too often the amateur user of a plane handles it as if it were a combination draw knife, scraper and chisel, without any regard to the principles on which it is constructed. Of course, it is easier to use a plane held at an angle than one held straight with the direction of the cut, because holding it at an angle reduces the size of the shaving and therefore requires less force to push it through the wood. But the evils which follow in the train of this angular holding of the plane are many. A plane is nothing but a chisel, held at the best angle for surface cutting and prevented from "biting" beyond a certain depth by the face of the plane. Now, if using a chisel to smooth off roughnesses on a board, no one would even try to hold it so that the blow of the mallet was in any other direction than the length of the chisel—to do so would be to risk marring the work and injuring the hand. Why, then, use a plane—which is nothing but a giant chisel properly held—so that the force of the blow (push) goes through the blade at an angle instead of straight? Solely for ease of working, and because it is less trouble. Yet, when it results in scoring the work, making an uneven surface, and sometimes "frittering" the wood (if it is a very loose grain) by picking up some of the fibers and pulling them loose, it would seem that there was little argument in favor of so doing.

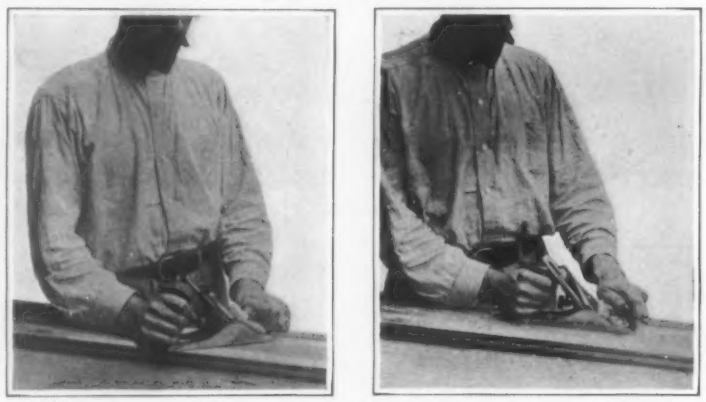
There is a right and wrong way to use a chisel, as well as every other tool. As just stated, the force of the blow must be so directly applied that it goes straight down the length of the chisel, but even that is not the whole art of the use of this tool. For the edge may be at an angle with the work, even though the blow is straight. And "edging in" with a chisel in mortise work is the most prolific cause of poorly made joints on amateur workbenches. The edge of a chisel is at right angles with its sides. In making a mortise, the sides are usually at right angles with the surface of the work, and the tenon which is to fit into the work is, of course, also an affair of right angles. To hold the chisel so that the edge of the blade is at any other angle than a right angle is to risk marring the edges of the mortise, and perhaps, if the mortise is "blind" and doesn't go through the wood, to cut too deeply in one part and leave an uneven "floor" or bottom to the "blind" hole. Of course, the chisel haft may be at an angle with the work when "lifting" out splinters and chips or making a "with-grain" cut, but the edge of the chisel should always be square with the work, regardless of the angle of the haft with the work.



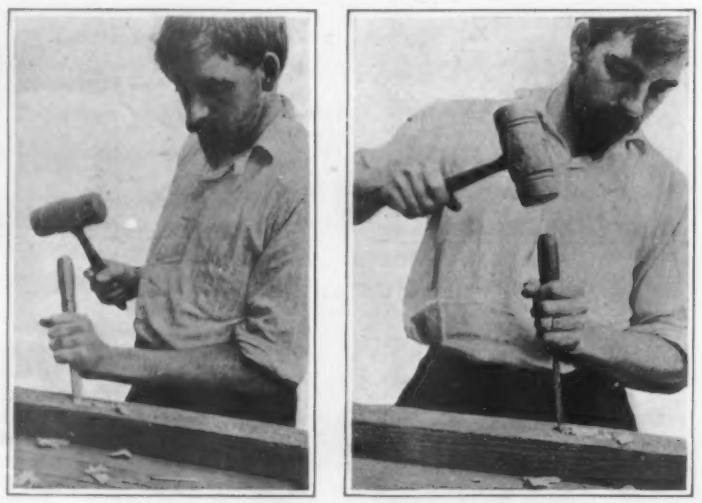
Converting a planer into a milling machine.



An angle of 45 degrees is best for sawing across the grain.



Scoring and frittering result from holding the plane at an angle.



The chisel should be held square with the work.

WRONG AND RIGHT WAYS OF USING TOOLS

Converting a Planer into a Milling Machine

By Albert F. Bishop

THE writer has in his shop a small hand planer of home manufacture. This planer has proved quite efficient. Not long ago 24 gears were cut on it by using an attachment which converted it into a milling machine, and revolving the cutter by foot power. The accompanying illustration shows the manner in which this was done. A small casting was made, as shown in the large detail view, to carry the milling arbor. This casting was fitted in the tool post of the planer. The arbor carried at one end a step pulley, while at the other end it was formed with a tapered end adapted to fit into a conical socket in a cap screw. The latter was secured firmly at the proper adjustment by means of a jam nut, and after the attachment had been applied to the planer a collar on the cutter arbor was secured in place to hold the arbor against the center in the cap screw. Cutters of various sorts were used on this arbor for milling the teeth of gears or for milling taps and reamers. The attachment proved very serviceable for a variety of work. The cross feed, as well as the feed up and down, and the removable table, made the tool as adaptable as any milling machine. A small latch was found necessary for the swinging tool post on the planer. This is indicated at *A* in the drawing. While this attachment was applied to a small hand planer, there seems no reason why it should not be applied to a small power planer by using some simple means for moving the table by hand.

Making Small Grinding Wheels

By H. D. Chapman

MANY grinding-machine operators make their own wheels for accurate internal work out of pieces broken from external wheels that have been worn down too small for further service, as such wheels cut more freely in the smaller sizes than those that are bought. The difficulty is to find a satisfactory method of making the holes in the pieces. This is generally accomplished with an old file tang or similar instrument.

After having tried several ways, I consider the following the best: Take a piece of steel tubing of external diameter approximately the size of hole required; and file three or four coarse teeth in the end of tubing just as in a hollow mill, then chuck the tube in a drill press, and with a slow speed it will take a core clean out of the piece of abrasive in a second or two. The teeth in the tubing will need renewing after cutting through a few pieces; this can quickly be done with a few strokes of the file.

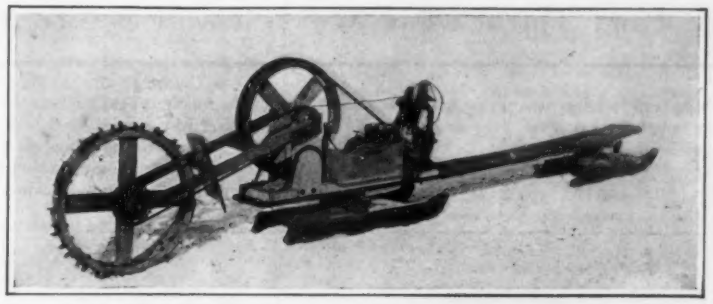
The outside of the wheel should be made concentric with the hole on a roughing bob, or with an old, rough file.

Curiosities of Science and Invention

READERS are invited to contribute to this department photographs of novel and curious objects, unique occurrences, and ingenious contrivances. Such as are available will be paid for promptly.

Motor Bobsled

A YOUNG man in Skowhegan, Me., has recently perfected a motor drive for his bobsled that is an object of envy among the boys about town. He removed the engine from the regular motorcycle and mounted it to the rear end of the bobsled. The engine is bolted to a large pulley on a counter shaft and the latter is connected by sprocket and chain to the driving wheel. The driving wheel is set in the rear end of a removable frame pivoted on the counter-shaft, so that it rises and falls readily cover all inequalities in the road. The rim of the driving wheel is studded with sharpened steel calks to give a firm grip upon the snow. A speed of ab- 20 miles per hour is attained. It will go up the highest grade that is found on the ordinary road at the rate of from 12 to 15 miles per hour.



Bobsled driven by a motor-cycle engine.

Memorial to Mouillard

ON February 25th a monument was unveiled at Heliopolis, just outside of Cairo, Egypt, to the memory of Louis Pierre Mouillard. The memorial was erected by the Egyptian section of the National Aerial League of France in recognition of the man who is considered by the French to have been the father of aviation. Mouillard's investigations in aeronautics began as early as 1849, when as a lad he managed to capture an eagle and made a careful study of the structure of its wings. From that moment his interest in aviation continued unabated. When in 1865 he moved to Cairo, he built a monoplane glider, with which he conducted a number of interesting tests. In 1881 he wrote a book on the "Empire of the Air." After his death in 1897 papers were discovered showing that he had investigated the manipulation of the wings during flight. It is the claim of French aviators that this work anticipated the warping wings of the Wrights.

To the French pioneer of aviation

Weeping branch on a curly willow.

A Wooden Tire for Motor Trucks

AMONG the many ingenious substitutes that have been evolved to supersede the expensive rubber tires for the commercial automobile, one that has appeared in England has a distinct claim to novelty, inasmuch as it is made of wood. For some years past, in view of the advance in the price of rubber. Mr. John Henry Knight, of Farnham, has been endeavoring to use wood as a substitute. An excellent instance of the elasticity of wood is afforded by the archer's bow, which retains its qualities for half a century or more. The accompanying photograph, shows one of the driving wheels of the inventor's Darracq car fitted with the new tire. Innumerable tests show that the tire is resilient and springy, will carry a load of 600 pounds or more, rides over inequalities in the road surface with ease, prevents skidding and seems to possess remarkable wearing qualities. The tire is built up of sections of ash, bolted on the rim of the wheel in two or more rows. The blocks break joint with one another. In the ends of the blocks are saw cuts, while a wedge-shaped piece is cut away to give greater elasticity. Before the blocks are bolted to the wheel, they are bent by steaming, but are given a somewhat greater curve than the circumference of the wheel. The blocks have steel cleats on them to prevent splitting.

Wooden tire for auto.

Grinding wheel tester.

The Bridge of the "Lusitania"

NAVIGATING bridges differ very much in their physical appearance. On most of the large steamers the bridge consists of a platform, front athwartship, commanding an unobstructed view of the fore part of the vessel and the open sea beyond. This platform is provided with a large deckhouse, with glass windows nearly an inch thick, which can be let down in fair weather. Practically everything, including the manipulation of the anchor, is controlled from the bridge, such as the important instruments and signals, including the compass, siren-blowing apparatus, engine signals, the submarine signals, the loud speaking telephone, the devices for showing the exact position of the rudder, the quantity of water in the trimming tanks, the exact position of every bulkhead door, devices for detecting fire and many other subsidiary signals. The bridge of the "Lusitania," which we illustrate, is mounted on a platform as described. The wheel which controls the steering apparatus is directly at the right behind the partition. The bridge of the "Lusitania" is 80 feet above the level of the water, yet it sustained severe injuries in the storms of January, 1910. The glass in the windows, which was of immense thickness, were smashed like paper, and the wheelhouse, steering apparatus, etc., disarranged temporarily.

Navigating bridge of the "Lusitania."

A Freak Willow Tree

SOME weeks ago an item appeared in this department describing peach trees which bore almonds. The accompanying illustration presents another very striking example of a reversion to type, if such it be. The "curly willow" tree was started some thirty years ago from a cutting, when last summer the "weeping willow" branch shown so plainly in the picture was noticed. There was no history of grafting, and, in fact, this "weeping" branch has one or two twigs of typical "curly" foliage on its upper end—just before the curve which introduces the typical weeping willow foliage. As will be noticed, the curly willow growth and foliage are a sort of compromise between the ordinary and the weeping willows, except for the tightly curved leaves. This particular branch, however, has all the weeping willow characteristics, with none of the brittleness of curly willow twigs and no sign of curling foliage.

Testing Grinding Wheels for Safety

IN order to determine the ability of a grinding wheel to withstand bursting under the centrifugal force developed when rotating at high speeds a large manufacturing company tests all its wheels before putting them on the market in a machine of the type here illustrated. The machine has two compartments with a single door so that while a wheel is being tested in one compartment the other compartment is open for the removal or mounting of another wheel.

This machine is equipped with a tachometer and a variable speed motor, so that wheels of different diameters may be tested at the proper speeds. Wheels larger than five inches in diameter are tested by running at 9,000 surface feet per minute, which is nearly at the rate of a mile and three-quarters per minute. The centrifugal force developed in the test is over three times that of ordinary working speeds. An 18 x 2-inch grinding wheel was tested every working day for five years at 9,000 surface feet per minute, to determine whether age, atmospheric conditions or continued running at high speed affected the safety factor. A permanent record of each test is made, which consists of the dimensions of the wheel, grade, order number, and the number of revolutions at which the wheel is tested. The testing speed is marked on each wheel and a record of the test is also made on the shipping check. The truthfulness of all testing records is sworn to before a justice of the peace.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

A Sugar Bowl With a Mechanical Discharge

IN restaurants, hotels, and other places where sugar is placed at the disposal of patrons, unsanitary conditions are apt to prevail. The sugar is usually left exposed to the dust and dirt in the air, and the sugar spoon is apt to be soiled by contact with food or with the hands of the patrons. To prevent these conditions an inventor has devised the sugar bowl illustrated herewith, which consists of a spherical vessel formed on one side with a delivery chute and provided internally with a pair of scoops that may be revolved to carry measured quantities of sugar to the discharge chute. The discharge chute has a cover that is normally closed. However, as a scoop comes around to the discharging point it automatically lifts the cover to the position shown by dotted lines. A pair of curved rods guide the scoop to proper position with respect to the discharge chute. Each scoop carries half a spoonful of sugar, so that a person may readily measure out the amount of sugar he wishes to use in his coffee or tea, and does not run the risk of over-sweetening the beverage. The shaft on which the scoops are mounted passes through the sides of the sugar bowl, and is provided at each end with a handle by which it may be turned.

Device for dealing out sugar.

Moving Pictures at Home

By the English Correspondent of the Scientific American

DURING the past few months a new and simple apparatus for taking moving pictures with as much ease as snap-shot photographs has become popular in Great Britain. The positives are not thrown upon the screen but are printed upon paper and observed somewhat after the same manner as the mutoscope productions. The feature of the system, however, is that amateurs have a means of taking motion photographs for their own entertainment either in their home circles or of popular events.

The "Kinora" camera which is employed for this purpose is highly ingenious and simple, the mechanism being quite different from that employed in the ordinary cinematograph apparatus. Externally, the instrument resembles the ordinary photographic apparatus for taking instantaneous 7x5 pictures. On the one side is the handle for driving the intermittent mechanism within, while at the back is the focusing arrangement, which is of such a character that there is no necessity to open the camera and to detach the film from the gate as in the cinematograph device for this operation.

The internal mechanism is of the simplest description. As may be seen by referring to the illustration there are two dark film cases for carrying the unexposed and exposed films respectively mounted one behind the other. The film does not require to be perforated, a new device having been perfected for bringing successive areas in position behind the lens. The film passes direct from the unexposed dark box into the gate, and thence between two split cams revolving in opposite directions, by means of the handle. Upon the completion of a revolution the split edges of the two cams come together, grip the film, and drag it down the depth of a picture—¾-inch—for the next exposure. From the gate the film passes over a roller into the second film box.

A reel of positive prints for the viewing machine.

The camera.

Interior view showing mechanism and paper negative in position in opened gate.

The viewing apparatus showing mounted reel of prints.

The film itself is narrower than that of the standard cinematograph as the preforations are not required, but the resultant image is of the same width, viz., one inch. As the preforations are eliminated the film cannot be used to produce positives for projection upon a sheet. In fact the camera is not designed for such work. The intermittent mechanism though simple is accurate and positive in its operation, the regularity of the pictures being equal in every respect with that obtained in the ordinary cinematograph using perforated film.

The camera, however, is not intended primarily to work with the celluloid film though this can be used if preferred. This film is so expensive as to render amateur cinematography an expensive luxury, so in order to remove this handicap the inventors have perfected an excellent negative paper.

The preparation of the positives or reels of pictures is somewhat intricate and must be carried out at the factory to which the photographer mails his negatives. A special type of machine has been evolved for producing the positives upon the reel ready for viewing, at a small charge. The leaves of the reel are about three inches in length by about 1¼ inches wide. The picture is 1 inch in width by ¾ inch in depth. Instead of the strip of positive picture being printed and then cut up to be mounted singly on a leaf in succession, the images are printed successively upon the leaf, the whole surface of which is sensitized. The area surrounding the picture being fully exposed becomes a dead black when developed, forming a frame for the picture. The reverse side of the sheet is then printed a dull black so that there is nothing to contrast with the image. The machine which carries out this operation is distinctly ingenious, and seeing that only one copy of each negative is likely to be required, has enabled the positive printing operation to be reduced to a nominal figure. When the pictures are printed they are cut up and mounted by machinery in succession upon the core as shown in the illustration.

The Acetylene Fog Horn

A PATENT has been issued to Gustav Dalen, of Sweden, by the Dominion of Canada, No. 135,339. This patent covers the production of sound of a given tone by means of a series of explosions of acetylene and air. A rotating disk containing little pockets on its periphery, which are exposed at one point to the air and at another to a jet of acetylene, and which brings the mixture to an electric spark in front of the aperture of a little horn, causing a series of explosions, the rapidity of which is based upon the speed at which the disk is rotated. Therefore, 500 explosions of acetylene per second are easily within reach; the tone produced by these series of explosions depending upon a prearranged calculation as to the rapidity of rotation.

Dalen is the inventor of the sun-valve for the acetylene buoy by means of which the light of day extinguishes the flame and darkness ignites it, and the object of the present invention is to place on the buoy a fog horn which will give warning at all times when a fog arises.

A problem yet to be solved, however, appears to be how to control the operation of the disk so that it will only run when needed. Although the consumption of acetylene is very small, some of the buoys are in such exposed conditions that they cannot be visited except at long intervals. A record of fifteen months' continuous service without attention has already been obtained. The gas capacity of acetylene buoys is necessarily limited; hence, some method must be devised to limit the consumption of gas for the production of sound. It has been proposed by Dalen, and the problem is now on the way toward completion, to utilize the tuning fork for this purpose. Vessels coming frequently to the same port might be equipped with whistles which could be attuned to the note of the tuning fork, and when approaching a dangerous coast in the fog would, as is the regular custom, blow the fog whistle. On approaching the buoy the tuning fork would be set in vibration and respond to its note; thereby releasing the disk, which would remain in action as long as the vibration continued; allowing for a reasonable distance, the whistle of the vessel would travel to the buoy, and the sound from the buoy would come back to the vessel in the form of an echo or answer, thus giving the necessary warning; the consumption of acetylene being limited to these short periods would scarcely be appreciable. In view of the fact that Gustav Dalen solved the problem of the sun-valve, which in delicacy of action is only equaled by its absolute reliability in all temperatures, it is not unreasonable to suppose that the solution of the problem of regulating the consumption of acetylene in the production of sound will be satisfactorily solved in the very near future.

Notes for Inventors

A Batch of Metal-working Patents.—In the issue of patents dated February 20th, 1912, Abraham B. Landis of Waynesboro, Pa., receives twenty-one patents, nearly all of which are for metal-working machines, such as bolt threaders, grinding machines, cutter heads, thread-cutting machines.

A Convertible Dress Coat.—Frank P. Matthews of Baltimore, Md., in a patent, No. 1,017,781, provides two coats in one, that is to say, he provides a coat which can be used for ordinary business purposes, as a frock coat or a cut-away coat, and can be conveniently converted into a full-dress or swallow tail coat. To do this, he provides the lapels with silk facings that can be brought into play when the coat is used as a dress coat and at other times can be folded back into pockets and out of the way. He also makes the skirt of the coat with the front parts adapted to be turned back into pockets formed to receive them to make the garment into a swallow tail coat, and when it is desired to use the coat for ordinary business purposes the said portions are brought out to complete the front of the skirts and detachably secured in place by suitable fastenings.

Pneumatic Tire Armor.—An application for a patent has been filed by George Longuemare, for an invention which may be described as a coat of mail for the pneumatic tires of automobiles. A specimen of the tire protector which we have seen consists of a great number of metal hexagonal plates which lock into one another, in the manner shown in the illustration. There can be no doubt that the protection would be effective against puncture. The tire user, however, will ask: What will it cost? Perhaps it may be cheaper to repair a tire, or even to

Pneumatic tire armor.

buy a new one, than to protect it with a coat of mail.

A Compensating Sound Record Groove.—A sound record which has a continuous record groove of the laterally undulating type, the depth of which decreases from the beginning to the end thereof in such manner as approximately to compensate for the wear of a reproducing stylus or needle when the latter is tracking such groove is shown in a patent, No. 1,012,910, to Stephen C. Porter of Martinsville, N. J., assignor of one-half to Walter H. Miller of Orange, N. J.

Roller-bearing Railroad Rail.—David Mauck of Greenville, Missouri, seeks to prevent a car wheel leaving the rail and to this end he, in a patent, No. 1,012,093, makes a railroad rail with rollers along the inner edge of the tread so that a wheel traveling on the rail will engage the rollers, the latter rotating in the direction of rotation of the wheel to prevent the wheel from leaving the rail. In securing the rollers, the rail is recessed longitudinally and the rollers fitted in the recesses, the walls of the latter slightly overlapping the rollers.

Novel Razor Blade.—In patent No. 1,011,938 Henry J. Gaisman of New York, assignor to Auto Strop Co., shows a double edged razor blade of thin metal with the metal adjacent to the cutting edges of less temper than the edge portions so that the blade will be permitted to bend back of the edges without danger of fracture.

An Elevator Operated by a Gasoline Engine.—Patent No. 1,012,003 was issued to Otis Elevator Co. of New York, as assignee of Charles O. Pearson, for an elevator in which an internal combustion engine operates the hoisting mechanism of the car, a clutch being provided for connecting the engine with the hoisting means, and mechanical means are actuated from the car for actuating the brake and clutch together, and for controlling the engine from the car.

Fabric Threads in Ice.—A Frenchman, Henri Marche of Fournies, France, in patent No. 1,012,389, discloses a method of manufacturing velvet, plush, carpet, and imitation fur in which he arranges threads in layers of any desired density and length, treats the threads with water and freezes. He then melts the ice away on one face, attaches the threads to a suitable support by an adhesive, and melts away the remainder of the ice.

One Toy Figure Operates Another.—Patent No. 1,012,279, to George A. Ringler of Lancaster, Nebraska, shows a mechanical toy having a swinging figure and a stationary figure, and a motor in the base below the figure operates the stationary figure in such manner as to cause it to operate the swinging figure. It also has means which are operated by the swinging figure to control the movement of the motor.

A Boon to the Bow-legged and Pigeon-toed.—The patent, No. 1,013,097, to Thomas M. Allan of Toronto, Canada, should prove a boon to bow-legged and pigeon-toed folk. It provides an exercising device designed to straighten bow-legs and knock-knees as well as pigeon-toes by means of suitably disposed pads in a frame and arranged to so bear against the opposite sides of the leg as to produce the desired straightening effect.

$7,500 for a Non-slipping Rubber Roadway.—An important announcement is to be made at the International Rubber Exposition which opens at the New Grand Central Palace in September next. The above named sum has been subscribed by a number of gentlemen connected with the rubber industry, and is to be offered to the inventor or inventors who can suggest the best method of making rubber non-slipping for pavements, roads, etc., or for any use to which it may be put in all atmospheres and for all kinds of traffic. The idea is to divide the sum into three prizes. An important point is that the inventor or inventors will have absolute right in the invention, the patent being conveyed free to the successful competitor or competitors.

Abstracts from the Decision in the Rotary Mimeograph Case

IN the case of Sidney Henry *et al.* vs. A. D. Dick Company, which involved the right to use upon a stencil duplicating machine known as the rotary mimeograph, inks and other supplies not purchased from the patentee, as called for by a license restriction printed on the machine, Mr. Justice Lurton, delivering the prevailing opinion of the court, said, among other things:

An absolute and unconditional sale operates to pass the patented thing outside the boundaries of the patent, because such a sale implies that the patentee consents that the purchaser may use the machine so long as its identity is preserved. This implication arises, first, because a sale without reservation of a machine whose value consists in its use, for a consideration, carries with it the presumption that the right to use the particular machine is to pass with it.

The argument for the defendants ignores the distinction between the property right in the materials composing a patented machine and the right to use for the purpose and in the manner pointed out by the patent. The latter may be and often is the greater element of value, and the buyer may desire it only to apply to some or all of the uses included in the invention. But the two things are separable rights. If sold unreservedly, the right to the entire use of the invention passes, because that is the implied intent; but this right to use is nothing more nor less than an unrestricted license presumed from an unconditional sale. A license is not an assignment of any interest in the patent. It is a mere permission granted by the patentee. It may be a license to make, sell and use, or it may be limited to any one of these separable rights. If it be a license to use, it operates only as a right to use without being liable as an infringer. If a licensee be sued, he can escape liability to the patentee for the use of his invention by showing that the use is within his license. But if his use be one prohibited by the license, the latter is of no avail as a defense. As a license passes no interest in the monopoly, it has been described as a mere waiver of the right to sue by the patentee.

We repeat: The property right to a patented machine may pass to a purchaser with no right of use, or with only the right to use in a specified way, or at a specified place or for a specified purpose. The unlimited right of exclusive use which is possessed by and guaranteed to the patentee will be granted if the sale be unconditional. But if the right of use be confined by specific restriction, the use not permitted is necessarily reserved to the patentee. If that reserved control of use of the machine be violated, the patent is thereby invaded. This right to sever ownership and use is deducible from the nature of a patent monopoly and is recognized in the cases.

If, then, we assume that the violation of restrictions upon the use of a machine made and sold by the patentee may be treated as infringement, we come to the question of the kind of limitation which may be lawfully imposed upon a purchaser.

To begin with, the purchaser must have notice that he buys with only a qualified right of use. He has a right to assume, in the absence of knowledge, that the seller passes an unconditional title to the machine, with no limitations upon the use. Where, then, is the line between a lawful and an unlawful qualification upon the use? This is a question of statutory construction. But with what eye shall we read a meaning into it? It is a statute creating and protecting a monopoly. It is a true monopoly, one having its origin in the ultimate authority, the Constitution. Shall we deal with the statute creating and guaranteeing the exclusive right which is granted to the inventor with the narrow scrutiny proper when a statutory right is asserted to uphold a claim which is lacking in those moral elements which appeal to the normal man? Or shall we approach it as a monopoly granted to subserve a broad public policy, by which large ends are to be attained, and, therefore, to be construed so as to give effect to a wise and beneficial purpose? That we must neither transcend the statute nor cut down its clear meaning is plain.

If the stipulation in an agreement between patentees and dealers in patented articles, which, among other things, fixed a price below which the patented articles should not be sold, would be a reasonable and valid condition, it must follow that any other reasonable stipulation, not inherently violative of some substantive law, imposed by a patentee as part of a sale of a patented machine, would be equally valid and enforceable. It must also follow that if the stipulation be one which qualifies the right of use in a machine sold subject thereto, so that a breach would give rise to a right of action upon the contract, it would be at the same time an act of infringement, giving to the patentee his choice of remedies.

But it has been very earnestly said that a condition restricting the buyer to use it only in connection with ink made by the patentee is one of a character which gives to a patentee the power to extend his monopoly so as to cause it to embrace any subject, not within the patent, which he chooses to require that the invention shall be used in connection with. Of course, the argument does not mean that the effect of such a condition is to cause things to become patented which were not so without the requirement. The stencil, the paper and the ink made by the patentee will continue to be unpatented. Anyone will be as free to make, sell and use like articles as they would be without this restriction, save in one particular—namely, they may not be sold to a user of one of the patentee's machines with intent that they shall be used in violation of the license. To that extent competition in the sale of such articles, for use with the machine, will be affected; for sale to such users for infringing purposes will constitute contributory infringement. But the same consequence results from the sale of any article to one who proposes to associate it with other articles to infringe a patent, when such purpose is known to the seller. But could it be said that the doctrine of contributory infringement operates to extend the monopoly of the patent over subjects not within it, because one subjects himself to the penalties of the law when he sells unpatented things for an infringing use? If a patentee says, "I may suppress my patent if I will. I may make and have made devices under my patent, but I will neither sell nor permit anyone to use the patented things," he is within his right, and none can complain. But if he says, "I will sell with the right to use only with other things proper for using with the machines, and I will sell at the actual cost of the machines to me, provided you will agree to use only such articles as are made by me in connection therewith," if he chooses to take his profit in this way, instead of taking it by a higher price for the machines, has he exceeded his exclusive right to make, sell and use his patented machines? The market for the sale of such articles to the users of his machine, which, by such a condition, he takes to himself, was a market which he alone created by the making and selling of a new invention. Had he kept his invention to himself, no ink could have been sold by others for use upon machines embodying that invention. By selling it subject to the restriction he took nothing from others and in no wise restricted their legitimate market.

For the purpose of testing the consequence of a ruling which will support the lawfulness of a sale of a patented machine for use only in connection with supplies necessary for its operation bought from the patentee, many fanciful suggestions of conditions which might be imposed by a patentee have been pressed upon us. Thus it is said that a patentee of a coffee pot might sell on condition that it be used only with coffee bought from him, or, if the article be a circular saw, that it might be sold on condition that it be used only in sawing logs procured from him. These and other illustrations are used to indicate that this method of marketing a patented article may be carried to such an extent as to inconvenience the public and involve innocent people in unwitting infringements. But these illustrations all fail of their purpose, because the public is always free to take or refuse the patented article on the terms imposed. If they be too onerous or not in keeping with the benefits, the patented article will not find a market. The public, by permitting the invention to go unused, loses nothing which it had before, and when the patent expires will be free to use the invention without compensation or restriction. This was pointed out in the Paper Bag case, where the inventor would neither use himself nor allow others to use, and yet was held entitled to restrain infringement, because he had the exclusive right to keep all others from using during the life of the patent. This larger right embraces the lesser of permitting others to use upon such terms as the patentee chooses to prescribe. It must not be forgotten that we are dealing with a constitutional and statutory monopoly. An attack upon the rights under a patent because it secures a monopoly to make, to sell and to use, is an attack upon the whole patent system. We are not at liberty to say that the Constitution has unwisely provided for granting a monopolistic right to inventors, or that Congress has unwisely failed to impose limitations upon the inventor's exclusive right of use. And if it be that the ingenuity of patentees in devising ways in which to reap the benefit of their discoveries requires to be restrained, Congress alone has the power to determine what restraints shall be imposed. As the law now stands it contains none, and the duty which rests upon this and upon every other court is to expound the law as it is written. Arguments based upon suggestions of public policy not recognized in the patent laws are not relevant. The field to which we are invited by such arguments is legislative, not judicial. The decisions of this court, as we have construed them, do not so limit the privilege of the patentee, and we could not so restrict a patent grant without overruling the long line of judicial decisions from Circuit Courts and Circuit Courts of Appeal, heretofore cited, thus inflicting disastrous results upon individuals who have made large investments in reliance upon them.

The conclusion we reach is that there is no difference, in principle, between a sale subject to specific restrictions as to the time, place or purpose of use and restrictions requiring a use only with other things necessary to the use of the patented article purchased from the patentee. If the violation of the one kind is an infringement, the other is also.

In his dissenting minority opinion Chief Justice White, expressing his own views and those of Justices Hughes and Lamar, remarked:

I am led to express the reasons which constrain me to dissent, because of the hope that if my forebodings as to the evil consequences to result from the application of the construction now given to the patent statute be well founded, the statement of my reasons may serve a twofold purpose: First, to suggest that the application in future cases of the construction now given be confined within the narrowest limits, and, second, to serve to make it clear that if evils arise their continuance will not be caused by the interpretation now given to the statute, but will result from the inaction of the legislative department in failing to amend the statute so as to avoid such evils.

The exclusive right of use of the invention embodied in the machine which the patent protected was a right to use it anywhere and everywhere for all and every purpose of which the machine as embraced by the patent was susceptible. The patent was solely upon the mechanism which when operated was capable of producing certain results. A patent for this mechanism was not concerned in any way with the materials to be used in operating the machine, and certainly the right protected by the patent was not a right to use the mechanism with any particular ink or other operative materials. Of course, as the owner of the machine possessed the ordinary right of an owner of property to use such materials as he pleased in operating his patented machine and had the power in selling his machine to impose such conditions in the nature of covenants not contrary to public policy as he saw fit, I shall assume that he had the power to exact that the purchaser should use only a particular character of materials. But as the right to employ any desired operative materials in using the patented machine was not a right derived from or protected by the patent law, but was a mere right arising from the ownership of property, it cannot be said that the restriction concerning the use of the materials was a restriction upon the use of the machine protected by the patent law. When I say it cannot be said I mean that it cannot be so done in reason, since the inevitable result of so doing would be to declare that the patent protected a use which it did not embrace. And this, after all, serves to demonstrate that it is a misconception to qualify the restriction as one on the use of the machine, when in truth both in form and substance it was but a restriction upon the use of materials capable of being employed in operating the machine. In other words, every use which the patent protected was transferred to Miss Skou, and the very existence of the particular restriction under consideration presupposes such right of complete enjoyment, and because of its possession there was engrafted a contract restriction, not upon the use of the machine, but upon the materials. And these considerations are equally applicable to the exercise of the exclusive right to vend protected by the patent unless it can be said that by the act of selling a patented machine and disposing of all the use of which it is capable a patentee is endowed with the power to amplify his patent by causing it to cover in the future things which at the time of the sale it did not embrace.

But the result of this analysis serves at once again to establish, from another point of view, that the ruling now made in effect is that the patentee has the power, by contract, to extend his patent rights so as to bring within the claims of his patent things which are not embraced therein, thus virtually legislating by causing the patent laws to cover subjects to which without the exercise of the right of contract they could not reach, the result being not only to multiply monopolies at the will of an interested party, but also to destroy the jurisdiction of the State courts over subjects which from the beginning have been within their authority.

I do not think it necessary to stop to point out the innumerable subjects which will be susceptible of being removed from the operation of State judicial power and the fundamental and radical character of the change which must come as a result of the principle decided. But, nevertheless, let me give a few illustrations:

Take a patentee selling a patented engine. He will now have the right by contract to bring under the patent laws all contracts for coal or electrical energy used to afford power to work the machine or even the lubricants employed in its operation. Take a patented carpenter's plane. The power now exists in the patentee by contract to validly confine a carpenter purchasing one of the planes to the use of lumber sawed from trees grown on the land of a particular person or sawed by a particular mill. Take a patented cooking utensil. The power is now recognized in the patentee to bind by contract one who buys the utensil to use in connection with it no other food supply but that sold or made by the patentee. Take the invention of a patented frame. It is now the law that the seller of the frame may stipulate that no other material shall be used in a house in which the window frames are placed except such as may be bought from the patentee and seller of the frame. Take an illustration which goes home to everyone—a patented sewing machine. It is now established that by putting on the machine, in addition to

the notice of patent required by law, a notice called a license restriction, the right is acquired, as against the whole world, to control the purchase by users of the machine of thread, needles and oil lubricants or other materials convenient or necessary for operation of the machine. The illustrations might be multiplied indefinitely. That they are not imaginary is now a matter of common knowledge, for, as the result of a case decided some years ago by one of the Circuit Courts of Appeal, which has been followed by cases in other Circuit Courts of Appeal, to which reference will hereafter be made, what prior to the first of those decisions on a sale of a patented article was designated a condition of sale, governed by the general principles of law, has come in practice to be denominated a license restriction, thus, by the change of form, under the doctrine announced in the cases referred to, bringing the matters covered by the restriction within the exclusive sway of the patent law. As the transformation has come about in practice since the decisions in question, the conclusion is that it is attributable as an effect caused by the doctrine of those cases. And, as I have previously stated, it is a matter of common knowledge that the change has been frequently resorted to for the purpose of bringing numerous articles of common use within the monopoly of a patent when otherwise they would not have been embraced therein, thereby tending to subject the whole of society to a widespread and irksome monopolistic control.

But even if I were to put aside everything I have said and were to concede for the sake of argument that the power existed in a patentee, by contract, to accomplish the results which it is now held may be effected, I nevertheless would be unable to give my assent to the ruling now made. If it be that so extraordinary a power of contract is vested in a patentee, I cannot escape the conclusion that its exercise, like every other power, should be subject to the law of the land. To conclude otherwise would be but to say that there was a vast zone of contract lying between rights under a patent and the law of the land, where lawlessness prevailed and wherein contracts could be made whose effect and operation would not be confined to the area described, but would be operative and effective beyond that area, so as to dominate and limit rights of everyone in society, the law of the land to the contrary notwithstanding.

Again, a curious anomaly would result from the doctrine. The law in allowing the grant of a patent to the inventor does not fail to protect the rights of society; on the contrary, it safeguards them. The power to issue a patent is made to depend upon considerations of the novelty and utility of the invention and the presence of these prerequisites must be ascertained and sanctioned by public authority, and although this authority has been favorably exerted, yet when the rights of individuals are concerned, the judicial power is then open to be invoked to determine whether the fundamental conditions essential to the issue of the patent existed. Under the view now maintained of the right of a patentee by contract to extend the scope of the claims of this patent, it would follow that the incidental right would become greater than the principal one, since by the mere will of the party rights by contract could be created, protected by the patent law, without any of the precautions for the benefit of the public which limit the right to obtain a patent.

Legal Notes

Recharging Acetylene Tanks.—In Prest-O-Lite Company v. Auto Acetylene Light Company, District Judge Tayler in the Circuit Court N. D., Ohio E. D., holds that the recharging by defendant of acetylene gas tanks made and sold by complainant for use on automobiles, when brought to defendant by the owners for that purpose, or the exchanging of such recharged tanks for empty ones, in each case placing a label thereon showing by whom the recharging was done, did not constitute unfair competition.

Salted Codfish Is Not a Breakfast Food.—The Court of Appeals of the District of Columbia has affirmed the decision of the Commissioner of Patents in the case of Johnson Educator Food Company v. Sylvanus Smith & Co., Inc. In dismissing the opposition by the Johnson Company, the well-known Educator Cracker and breakfast cereals concern, to the registration of the word Educator as a trade-mark for fish, the Court said, "In the present case it requires altogether too great a stretch of the imagination to conclude that any one calling for breakfast food would accept salted codfish without knowing the difference. The general and essential characteristics of the two products are dissimilar, and while each is prepared for human consumption, no confusion such as the statute contemplates can possibly arise in the mind of the public if the two products are sold under the same mark."

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

LADY'S HAT FASTENER.—J. BELASCO, 77 Madison Street, New York, N. Y. This invention consists in providing a bowed comb-like member pivotally mounted in the hat structure and adapted to be rotated to bury the teeth of the comb in the wearer's hair after the hat is adjusted on the head, means external to the hat structure for rotating the comb being provided.

COLLAR AND TIE.—A. C. HEICHELBECH, care of Journal Printing Office, West Baden, Ind. This invention relates generally to wearing apparel and more particularly it involves an improved collar and tie adapted for use with each other whereby an improved article of wear is provided which presents a finished appearance to a person's dress, at the same time providing a novel form of outfit.

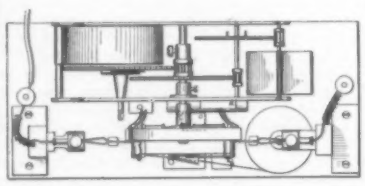
PLACKET FASTENER.—JULE S. BASHAW, Gainesville, Fla. In the present patent the invention relates to plackets of skirts, and its object is the provision of a new and improved placket fastener, arranged to securely hold the placket closed when the skirt is worn and to permit the wearer of the skirt to conveniently close or open the placket.

Electrical Devices.

DEVICE FOR GRAPHICALLY REPRODUCING SOUND WAVES.—H. G. DORSEY, 201 W. 105th Street, New York, N. Y. For the purpose of reproducing sound waves so that they can be relatively compared and accurately measured, use is made of a corrugated indented sound-receiving diaphragm, an adjustably mounted mirror, and a connection between the diaphragm and the mirror whereby the latter will operate when sound waves are received on the diaphragm.

COUPLING FOR ELECTRIC FIXTURES.—J. T. BARTLEY, care of E. M. Erb, 87 Greene Street, Jersey City, N. J. This inventor provides a hanging coupling device which will in accordance with the city ordinances permit the lead wires to pass outside of the hanging device between the conduit and fixture, and provides a hanger for electric fixtures which will accommodate the angularity of disposition of the structure to which it is connected, and thereby permit the fixture to be centered by moving the structural device to which said structure is attached.

AUTOMATIC FUSE RESETTER.—J. B. ELKIN, care of J. H. Berry, Columbia, S. C. The main object of this invention is to provide a device to be used in connection with telegraph or telephone circuits for resetting fuses which have been burned out by lightning. A further object is to provide a device for auto-



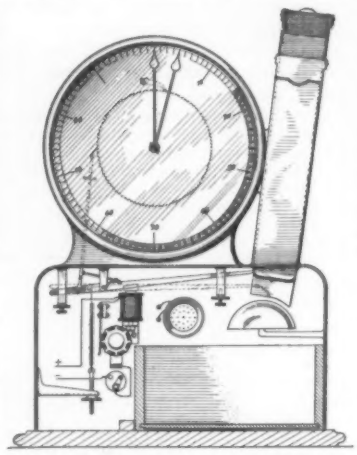
AUTOMATIC FUSE RESETTER.

matically resetting fuses which will be capable of resetting any number, thereby obviating the necessity of setting the device after each operation preparatory to the next operation. The device comprises a reel upon which the fuse wire is carried and which will feed the wire from the reel and bring it into position for automatically inserting a portion of it in the main circuit. The engraving herewith shows a plan view of the device.

SANITARY PROTECTOR FOR TELEPHONE TRANSMITTERS.—C. ADAMS, 4093 Ferris Street, Wood Haven, L. I., N. Y. This protector is arranged for convenient attachment to or removal from the telephone transmitter, the protector or shell when in use covering not only the mouthpiece, but also the casing of the transmitters, so that disease germs are not liable to be deposited on the instrument by the exhalation of persons using the instrument, and the user is not liable to be infected by germs exhaled by a prior user, the protector being sufficiently cheap to permit of throwing it away after being once used.

ELECTRICALLY OPERATED DOOR.—G. KORYTOWSKI, Berlin, Germany. This invention relates to improvements in electrically operated doors adapted to open in either direction, whereby the following effects among others are obtained: The door is invariably opened by turning in the same direction in which one wants to pass through, and when one is out of reach of the door, it is automatically turned back. The door may be locked in any position. During opening, the door is obliged to first complete its full turn, before released, and is automatically turned back. When desired, it may be locked in any position. Where preferred, the door may be operated only after the current has been closed, by the porter or by means of coin-freed apparatus.

REGISTERING DEVICE FOR TELEPHONE SYSTEMS.—E. M. NORTHUM, Stephens, Ark. This invention has for an object the facilitating of posting books and the checking up of telephone calls, especially those calls received on toll lines. A further object is to provide a device for registering calls which is oper-

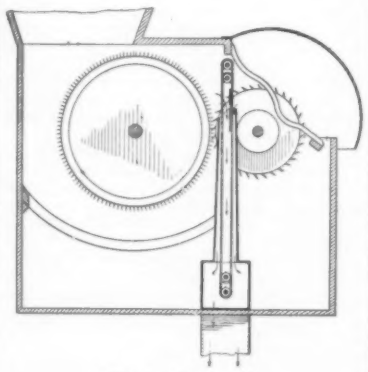


REGISTERING DEVICE FOR TELEPHONE SYSTEMS.

ated by disks, each of which constitutes in itself a record of the call so recorded. Another object is to provide a device in which the registering of the call is not only made, but the notification of such record may be transmitted to a distant operator, such as a monitor. Finally, an object is to provide a device comprising a dial having two hands therefor, one of which may be in use during the day and another during the night, these hands being shown in a face view herewith of the registering device, a portion of latter in section.

Of Interest to Farmers.

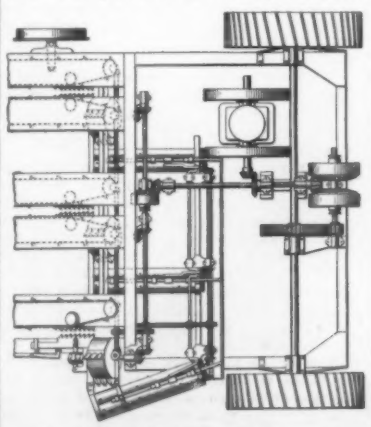
GIN ATTACHMENT.—E. A. ROZIER, SR., Sparta, Ga. Mr. Rozier's invention is an improvement in gin attachments, and has for its object the provision of a simple device for use in absolutely removing all of the motes and black specks in cotton during the operation of ginning, and for use in removing earth stains,



GIN ATTACHMENT.

which may be applied to the ordinary or usual gin without any material changes in the said gin. The belts shown in the accompanying engraving of a vertical longitudinal section travel slowly, and as they move they carry away the motes, specks and dirt mentioned above that are combed from the lint by the bristles before the said lint is removed from the saws by the brush.

CORN PICKING AND HUSKING MACHINE.—W. H. RUSSELL, Arcadia, Ind. This machine is adapted to be mounted upon and actu-

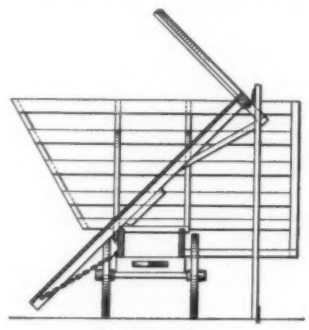


CORN-PICKING AND HUSKING MACHINE.

ated by a traction engine, and is shown herewith in a plan view looking down upon the invention, with parts of the guiding means broken away. The object of the inventor is to provide a machine for use in picking ears of corn off the standing or matured stalks, to husk the picked ears of corn, and to pass them through a conveyor to a wagon or other receptacle. The improvement more particularly relates to means by which the stalks are fed to the picker, and to a new and improved way in which the ears are picked from the stalks.

DEVICE FOR USE IN CURING HAY IN THE FIELDS.—J. LIESENFELD, Park Rapids, Minn. This invention relates generally to a structure forming a support for a quantity of hay and more particularly it involves a device of few parts adapted to support a stack of hay remote from the ground, whereby the curing of the hay is facilitated. When tearing down the haycock a pin is withdrawn, which allows the ground rod to be pulled up bodily, the lower ring with the legs thereon being left under the mass of hay.

DUMPING RACK.—H. F. HILBORN, Mohall, N. D. This invention relates to a dumping apparatus, and the purpose is to furnish a fodder rack or frame, by which corn or other fodder may be easily and rapidly removed from the wagon while the latter is moving forward, thereby saving time and labor. A further object is to provide gates to prevent the material from being scattered during the



DUMPING RACK.

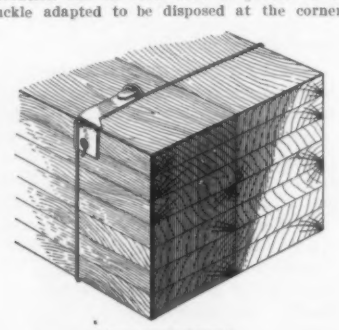
dumping process. The rack is shown in the engraving with the platform in tilted position. The apparatus has been demonstrated at Fargo, Grand Forks and at other fairs last threshing season, and has created much interest among farmers and machine men of the Northwest, as its steady feed threshes from 300 to 700 bushels more of grain than by the old methods.

Of General Interest.

ADJUSTABLE SCAFFOLD.—D. J. MUNS, Dublin, Ga. This invention comprises a winding drum or the like which can be operated by a person on the scaffold, to lift the same to any height, and means are provided for holding the scaffold when the same is raised to the required height, and which can be readily engaged with a support so as to hold the platform in its raised position, and readily released therefrom to permit the same to be lowered.

TYPOGRAPHIC STAMPING APPARATUS.—O. SACK, Brühl, 2 Connewitz, Saxony, Germany. This invention relates to apparatus for producing impressions of type in metal plates, which can be subsequently used for printing. The stamps employed are mounted on separate levers, which are mounted on a support, or there may be several complete sets, having separate supports which are adapted to be moved separately into stamping positions, so that the several sets of type can be alternatively used. Guides for the stamps insure each character being placed in its correct position, with a view to the formation of straight lines of stamped characters.

BALE TIE BUCKLE.—S. L. AUSTIN and H. COLES, care of Globe Lumber Co., Yellow Pine, La. Among the principal objects which the invention has in view are: to provide a tie buckle adapted to be disposed at the corners



BALE TIE-BUCKLE.

of a bale to be bent thereon in holding relation therewith, and to form a cinching member for assisting in drawing the tie member; to provide a buckle simple and economical in

(*Continued on page* 276.)

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Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Inquiry No. 9263.—Wanted, name and address of manufacturer of pantaloon stretchers with clamps, which is capable of being folded up.

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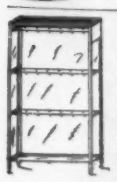

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Morning and Evening Stars

(*Concluded from page 267.*)

lion miles, and accomplishes a revolution in 224.7 days. On August 12th the planet reaches nearly the same position as that of January 1st; the difference is the distance traversed in 7/10 of a day. The dates indicated without the orbit refer to the first revolution, and those within to the second revolution.

Mars.

The orbit is inclined to the ecliptic at an angle of 1.85 degrees. The mean orbit radius is 141.5 million miles, and the eccentricity is less than 1/10, making the actual distance from the sun to *c*, the center of the orbit, 13.2 million miles. At perihelion Mars' distance from the sun is, therefore, reduced to 128.3 million miles; and at aphelion is increased to 154.7 million miles. At a mean velocity of 15 miles a second, Mars accomplishes his revolution in 1.88 years.

The Asteroids.

The orbits of the asteroids are situated between those of Mars and Jupiter. Since these little bodies are too small for naked eye observation—the diameter of the largest being not more than 500 miles—it is not necessary for the purpose of this article to do more than allude to them as filling a gap in the solar system.

The Major Planets.

Since the diameter of Neptune's orbit is thirty times that of the earth, it is not possible to represent the orbits of all the planets to the same scale satisfactorily within the limits of this page. The orbits of the terrestrial and major planets are therefore shown in separate plots, and the scale of the latter is very much smaller than that of the terrestrial planets. The difference of the scales will be seen by comparing the orbits of the earth and Mars in the two plots; in this way the continuity of the solar system will be apparent.

Jupiter.

The plot shows that the planet is above the ecliptic and approaching the descending node. Jupiter's orbit is inclined at an angle of 1.3 degrees; the eccentricity is nearly 1/20—i. e., the center of the orbit is 23.3 million miles from the sun—and at a mean distance of 483.3 million miles, Jupiter, with a velocity of 8.1 miles per second, completes a revolution in 11.86 years. At perihelion the planet comes within 460 million miles of the sun; and at aphelion this distance is increased to 506.6 million miles.

Saturn.

Saturn has a velocity of six miles a second; and at a mean distance of 886 million miles makes a revolution in 29.46 years. The orbit is inclined at an angle of nearly 2.5 degrees, with an eccentricity of a little over 1/20, which reduces the distance to about 836 million miles at perihelion, and increases it to about 936 million miles at aphelion. The planet is now below the ecliptic and approaching perihelion.

Uranus.

The linear eccentricity of the orbit is the greatest in the solar system. This is on account of the vast distance of the planet from the sun, which is over nineteen times that of the earth. The eccentricity is less than 1/20. The distance from the sun to the center of the orbit is 82.5 million miles. With a velocity of 4.2 miles a second, Uranus makes a revolution in 84.2 years.

Neptune.

The outermost planet completes its long period of 164.78 years at a velocity of 3.4 miles per second; and at a distance of 2,791.6 million miles. The eccentricity is less than 1/100, and as a consequence, notwithstanding the great distance of the planet from the center of our system, the distance from the center of the orbit is only 25,000,000 miles.

Conjunctions and Oppositions.

The table gives the dates of all the conjunctions and oppositions for the year 1912; and the plot of the terrestrial planets shows the positions of the earth and of the planet when a conjunction or opposition occurs, the hour of the day corresponding with the measurement of the orbit. The arrow indicates the direction in which a planet is seen. Jupiter's positions are given at intervals of 28 days;

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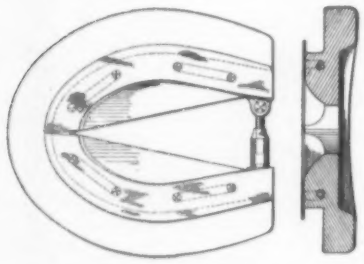
form and construction; to provide a method of manufacturing a buckle whereby the cost of construction is economized, and to provide a buckle readily released from holding engagement. The view shown is of a bundle of boards secured by a tie member and buckle constructed in accordance with the invention.

SHEET METAL WINDOW SASH AND FRAME.—M. SWARTZ, 65 Grattan Avenue, Brooklyn, N. Y. This invention provides a construction of frame and sash therefor to avoid the necessity of using separate stop and molding strips; provides a sash constructed in a manner to form a continuous guide slot, and provides a means for installing the glass in sashes conveniently and securely.

HUMIDOR.—W. H. BROWNING, 16 Cooper Square, Manhattan, New York, N. Y. This invention pertains to a humidor adapted to be used to contain water for moistening cigars in cigar jars and the like, and also adapted placed in a chiffonier with apparel, to impart thereto a delicate scent, and is an improvement of the construction disclosed in a former patent granted to Mr. Browning.

UNDERCURRENT WATER MOTOR.—H. H. GRANGER, care of Granger Under-Current Water Motor Co., Davenport, Wash. In general construction the device comprises a wheel which is rotated by the force of the current and this wheel is provided with vanes which are pivotally attached. The wheel is constructed in such a way that as the vanes move down stream with the current they come against stops which hold them substantially radially.

IMPROVED HORSESHOE PAD.—JEROME B. MCARDLE, 325 Valley Road, West Orange, N. J. The rubber pad shown in the accompanying illustration is so designed that it may readily be applied to or detached from a horseshoe while the shoe is on the horse's

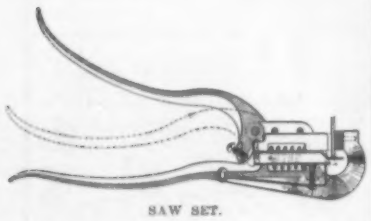


IMPROVED HORSESHOE PAD.

foot. It is arranged to cover the shoe and hoof, except for the space occupied by the frog of the foot, and it will prevent ice and snow or dirt from accumulating between the hoof and the pad. The pad is made with a metal plate molded into the rubber. This forms a flange, as shown in the sectional view, which is adapted to slip between the shoe and the hoof inside the curve of the horseshoe. At the rear of the pad there is a spreading device which may be quickly operated to spread the two ends of the plate apart and wedge it tightly against the horseshoe.

Hardware and Tools.

SAW SET.—J. H. JENNINGS, care of Merrill Iron Works, 603 First Street, Merrill, Wis. The invention has reference to a new and improved tool for setting the teeth of a saw, to obtain the desired clearance. An object of the inventor is to provide a saw set which will be simple in construction, inexpensive to manufacture, strong and durable, readily adjusted, easily manipulated, and which will perform work on both wide and narrow saws. A further object is to provide a saw set which will offset the teeth in the thin place of the saw more than in the thick place, so that the points of the teeth will be in alinement, no matter how much the saw varies in thickness. The engraving presents a partial vertical section of the tool.

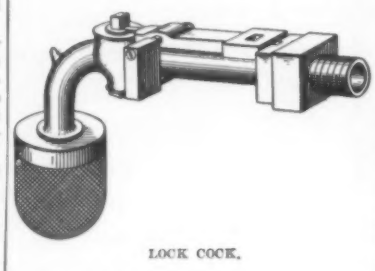


SAW SET.

CABLE AND WIRE CUTTER.—W. J. SHEEHAN, Box 66, Coalinga, Cal., and J. H. GILBERTSON, Coalinga, Cal. The improvement in this case has reference generally to a cutting device which is employed in cutting the wire rope used in well drilling. The purpose of the invention is to provide an efficient device for use in cutting the operating cable or rope when the rope socket, which carries a suitable drilling tool, becomes stuck or wedged tight in the well drilling.

RETHREADING TOOL.—D. G. CARBARINO and C. W. ROESSLE, 905 New York Avenue, Brooklyn, N. Y. In this patent the object is to devise a tool which will re-form the threads on screws or bolts, and it comprises means for engaging the screw or bolt to be rethreaded, in combination with means having a cutting edge which fits the groove between the threads.

LOCK COCK.—C. STIFT, care of H. Hackfeld Company, Ltd., Honolulu, Hawaii. Mr. Stift's invention relates in general to a means for locking the stopcocks of faucets, and more particularly is adapted for use in locking a gasoline pump cock to prevent surreptitiously stealing of the gasoline from garages. The main object is to provide an extremely simple



LOCK COCK.

article which can readily be applied to the ordinary type of structure, and at the same time constitute an effective lock for preventing the turning of the cock or valve. By means of the device the key may be fastened in a non-operative position to the body of the structure, and at the same time prevent the actuation of the valve by any other tool. These objects are attained by locking the key in position on a part of the faucet to engage a recess in the valve stem, thus preventing rotation of the same. The cock is shown in the illustrated perspective view.

WIRE-STRETCHING DEVICE.—L. M. DAVIDSON, P. O. Box 56, Eldorado, Ill. An object here is to provide a device by means of which a wire may be tightly stretched with very little effort on the part of the operator. A further purpose of the improvement is to provide a device which is of light weight and easily carried from place to place. The device has relatively few parts, and is simple in construction and not liable to get out of order.

PENCIL SHARPENER.—S. MCILVANIE, Eburne, B. C., Canada. In this device the rectangular cover or blade and the curved shank or handle are both constructed integrally from a flat piece of steel. The end of the blade is beveled on the upper side only, to form the required cutting edge, and the shank is curved consecutively with the blade so that both are concave on the upper side.

SAFETY RAZOR.—L. NAHEMOW, Manhattan, New York, N. Y. The invention is arranged to permit convenient handling and cleaning of the parts and opening of the same for the insertion or removal of the blade and quick closing of the parts for securely holding the razor blade in position while shaving. To accomplish the desired result the clamping member is pivotally connected at its ends with a sectional head provided with a handle.

Household Utilities.

WINDOW SCREEN.—G. W. STEIN, 842 West Jackson Boulevard, Chicago, Ill. This screen will permit the window sash to be raised during a rainstorm without danger of rain beating in. It partakes of the nature of a blind so as to keep out the glaring sunlight, but which will, nevertheless, permit air to pass freely as with the ordinary screen. Further, the invention provides a combined screen and fly escape.

OIL BURNER ATTACHMENT FOR STOVES.—I. L. MITCHELL, corner A Avenue and Fourth Street, Cedar Rapids, Iowa. In the present patent the invention comprises an oil vaporizer and burner and a support therefor which is so constructed that it may be placed in the firebox of a stove or other heater and supported detachably therein. Means provide for a high degree of heat, which extends laterally to the cooking utensils placed in the stoveholes.

Machines and Mechanical Devices.

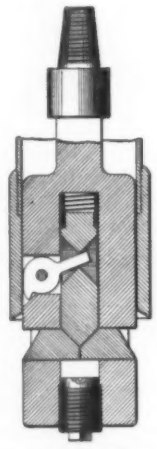
PERCUSSIVE TOOL.—ARTHUR G. GRICE, Carnoustie, County of Forfar, Scotland. In this patent the invention has reference to percussive tools, the object being to produce a tool of this type which is economical to manufacture, is simple and efficient in construction and action, is easy of assembling of mechanical parts, and is particularly suitable for dressing stone although it may be used for other purposes.

SAW GUMMING MACHINE.—L. GOAD, JR., Box 261, Arcata, Cal. The object here is to provide a machine which has feed fingers which automatically advance the saw step by step, so that the emery wheel may be applied between all the teeth respectively. Means provide for holding the saw in place relatively to the machine by raising and lowering the emery wheel, and for adjusting the feed fingers to meet all conditions.

DECORTICATING MACHIINE.—DR. L. LADEVAN, 2522 Berlin Street, New Orleans, La. An object here is to provide a device by means of which the removal of the bark may be thoroughly accomplished, and the extension of the tar product may be simultaneously effected. A further object is to provide a device in which the water used for extracting the tan product may be heated by passage through the water jacket of an engine or other motor, this resulting in the cooling of the motor and in the heating of the water prior to its use.

FLYING MACHINE PROPELLER.—W. H. LAWRENCE, care of "Store," 995 Manhattan Avenue, Brooklyn, N. Y. This invention has reference to improvements in rotary fans or propellers adapted to act upon the air, and more particularly to such air propellers as are used for propelling airships or flying machines which are actuated either by hand or by a suitable mechanical device.

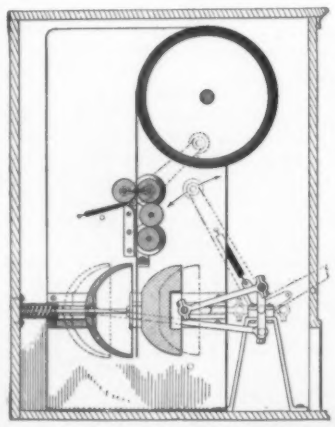
UNDER-REAMER.—G. E. SQUIRE, 42 Morris Street, Jersey City, N. J. This invention relates to an under-reamer for enlarging the holes of wells below the standpipe or casing, for lowering the latter to a desired depth, and arranged to insure quick and accurate reaming without danger of the cutters becoming clogged, at the same time allowing



UNDER-REAMER.

convenient lowering of the under-reamer into position, or withdrawing the same from the well after the reaming is completed. For this purpose use is made of reaming cutters mounted to slide diametrically in the stock and projected outwardly by a spring-pressed mandrel slidable lengthwise in the stock, which locks the cutters in projected active position. The engraving is a sectional side elevation of the under-reamer in position in the casing prior to lowering the under-reamer to a lowermost active position.

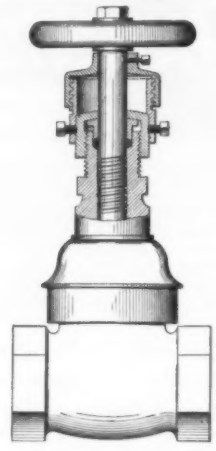
MACHINE FOR MAKING SANITARY DRINKING CUPS.—G. H. KAISER, 41 East Eleventh Street, Portland, Ore. An object of this inventor is to provide a device to be stationed near the place at which the cups are to be used, the user forming the cup himself preparatory to using it. A further object is to provide a device of few parts and comparatively simple construction for enabling the operator to quickly and easily form a drinking cup. Further, to provide a device having a roller, upon which are a series of blanks to be used in making the cups. The



MACHINE FOR MAKING SANITARY DRINKING CUPS.

machine is pictured in the illustration herewith, which gives a sectional view from front to rear.

VALVE.—E. A. LOWE, North Weare, N. H. The constant opening and closing of the port in a valve provided with a threaded valve-stem will in time cause the mating threads between the stem and its casing to become worn; and particularly is this true of the so-called globe valve, where the closing of the valve is accomplished by the forcing of the valve-head with considerable pressure against its seat, which places considerable strain on the threaded connection between the valve-stem and its casing. In time this wearing of the threads strips one or both of the threads, rendering the valve practically useless. This



VALVE.

inventor's aim is to produce an attachment for valves of the globe valve type whereby in the event of partial destruction of threaded connection between valve-stem and its casing an auxiliary threaded connection insures proper operation of valve-stem and its head to prolong the valve's life. The engraving shows a front elevation of a valve.

Railways and Their Accessories.

RAIL CLAMP.—C. ORENSTEIN, 601 West 4th Street, Sedalia, Mo. An object here is to provide a device whereby the rail may be rigidly and firmly attached to the railroad tie. A further object is to provide a means for tying the rail to the tie, whereby the spikes holding the plate to the tie are protected. Means provide for holding the rail to the tie to give a broad bearing on the rail, to firmly hold the same in position.

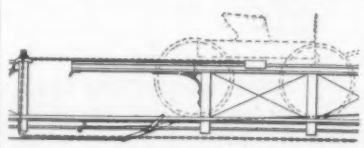
RAIL TIE AND FASTENING DEVICE.—J. V. BERGEN, El Paso, Texas. The aim in this improvement is to provide a tie made of reinforced concrete or similar material in which there is economy of material in the metal parts, the latter being cheaply manufactured, but serving to render the tie strong and durable. The tie has means for use in preventing the creeping of rails.

CAR WHEEL CLAMP.—W. E. IRONS, L. B. 36, Wilsoncreek, Wash. This inventor provides means for holding to the railway track the car carrying wheels while jacking the journal boxes to replace the brasses therein; and provides a device of the character mentioned, simple and efficient in construction and operation, and adapted to be quickly and readily handled.

RAILROAD VELOCIPEDE.—I. J. MOSSMAN, 3015 North Twenty-sixth Street, Tacoma, Wash. This inventor provides a vehicle with means for applying power both by foot and hand, and also to furnish means for amplifying or augmenting the power when an additional rider is carried on the vehicle; and provides a construction of propelling levers which co-act to materially augment the propulsive power applied.

Pertaining to Vehicles.

RUNAWAY STOP.—JOHN PETERSON, 234 Halsey Street, Brooklyn, New York, N. Y. This invention has reference more particularly to apparatus for halting runaway horse-propelled or other vehicles, and is employed in combination with a bridge or other roadway, comprising a normally inoperative movable member adapted when projected into an operative position to be engaged by a vehicle traveling



RUNAWAY STOP.

along the roadway, and means for controlling the movement of the member. The inventor provides an apparatus for bringing to a stop runaway vehicles of different types with a minimum of damage to the vehicle and with certainty and rapidity, which can be employed with the roadways of bridge or other structures, or at other localities, and which can be controlled and manipulated simply and rapidly from distant points. The illustration pictures a side elevation of a portion of a bridge roadway with certain of the parts in different positions.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Saturn's at intervals of 60 days, and those of Uranus and Neptune at the dates of opposition and conjunction. The plot of the orbits of the major planets gives their positions at the beginning and end of the year, and a comparison of the plots will assist in realizing the position of the earth relative to a planet at any assigned date.

How to Determine Morning and Evening Stars.

Mercury is in inferior conjunction (planet between earth and sun) three times during the year. Prior to conjunction he is evening star; after conjunction he is morning star. The planet is in superior conjunction (sun between earth and planet) three times. Prior to conjunction it is morning star; after conjunction it is evening star. The positions of earth and Mercury are shown by arrows at each conjunction.

Venus is in superior conjunction on July 5th. Prior to this date—i. e., for the first six months of the year—Venus is morning star, and then evening star for the rest of the year.

Mars is in conjunction on November 1st. Until that date the planet is evening star, and then morning star for the remainder of the year.

Before conjunction a major planet is evening star; after conjunction it is morning star. At the date of opposition it is above the horizon before and after midnight, and the planet is both morning and evening star.

GREENWICH TIME, 1912.

PLANET.	CONJUNCTIONS.	OPPOSITIONS.
Mercury	March 2 (sup.)	.....
"	April 15 (inf.)	.....
"	June 17 (sup.)	.....
"	August 21 (inf.)	.....
"	October 3 (sup.)	.....
"	December 8 (inf.)	.....
Venus	July 5 (sup.)	.....
Mars	November 4	.....
Jupiter	December 18	May 31
Saturn	May 14	November 22
Uranus	January 20	July 24
Neptune	July 15	January 13

Amundsen's Attainment of the South Pole

(*Concluded from page 265.*)

in King Edward VII. Land, near the eastern end of the ice front, and on the opposite side of Ross Sea, from the point at which Scott and Shackelton have made their successful entrances into the interior of the continent. The expedition was in winter-quarters at Whale Bay until September, 1911, and, on the 20th of October, the main party made the final start for the South Pole, leaving a subsidiary party to carry on explorations and make a geological collection in King Edward VII. Land.

In less than a month, the south-bound expedition had cleared that vast plain of floating ice which flows down from the great mountains of the interior and covers the southern part of Ross Sea throughout an area above 20,000 square miles with an ice sheet approximately 800 feet in thickness, and had begun to climb the heights which form the mountainous embayment at the head of Ross Sea. The glacial streams descending through the depressions among the mountain slopes constituted the usual lines of travel, and the route developed was new and independent, passing among mountain peaks rising to the height of 15,000 and 18,000 feet above the sea and gradually mounting to a maximum level before the Pole was reached and thence descending very gradually for 140 miles over a vast plateau to the position which was occupied on December 15th and 16th, 1911, and determined to be the South Pole.

As a result of Amundsen's Expedition, important additions may be laid down upon the map of Antarctica in the sector of the earth's surface extending from the South Pole to the 80th degree parallel of latitude between the meridians 160 degrees and 180 degrees west of Greenwich.

The theory of the structural unity of the Pacific is well established, and, according to it, the Pacific Ocean must be bounded on the south by a coast of the "Pacific type." With one exception in Central America, the whole of the known coasts of the Pacific belong to this type. The main characteristic of this form of coast is that the trend is determined by mountain ranges running parallel to the shore. In the South Pacific, this type is well exemplified in New Zealand on one side and by the Andes of South America

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on the other. In the southern part of Patagonia the Andes are turned from their meridional course and run eastward across Tierra del Fuego. The tectonic line of the Andes is then apparently bent southward and reappears in Palmer Land. It is probably continued around the southern Pacific meeting the end of the New Zealand line and the Victoria Range in the mighty mountains which Amundsen, in his approaches to the South Pole, discovered in the shape of what he has named the Maude Range stretching off to the southeastward as far as 88 degrees south. The principles of geomorphology would also suggest that from the lofty mountain axis bordering the Pacific there should slope downward, across the Pole, a broad plateau to Weddell Sea on the one side and the bight between Wilkes Land and Enderly Land on the other; and this interpretation is borne out by the description of the plateau conditions which were found to exist around the South Pole.

So far the facts published concerning the information gathered by Amundsen are chiefly geographical and topographical, and hence the illustration of the nature of the scientific bearings of the accessions to knowledge which his expedition has produced are drawn from these materials; but, as other branches of the information embraced in his observations are unfolded, other theoretical applications will appear for the advancement of philosophy and such of the geographical sciences as meteorology and terrestrial magnetism, concerning which the observations made in the South Polar regions tend in some respects to deliver the deciding stroke in the elaboration.

The Mercury Vapor Rectifier for Heavy Currents

THE mercury vapor rectifier invented by Peter Cooper Hewitt a number of years ago has found an important place in the automobile industry for charging storage batteries. Rectifiers made for this purpose take as much as 50 amperes at 220 volts alternating current and converting to 110 volts direct current. Rectifiers of even larger capacity are used for series arc lamp work to operate on lines of from 500 to as much as 5,000 volts, delivering anywhere from 4 to 6.6 amperes. Hitherto no use has been made of this form of rectifier for such heavy currents as are required for railway purposes. Now, however, Mr. Hewitt announces that he has made experiments with heavy currents and high voltages which show that the rectifier may be used successfully to take the place of the expensive rotary converters now in use for changing alternating current to direct.

The principle upon which Mr. Hewitt's rectifier operates is simple. In a bulb containing some mercury and from which the air has been exhausted so that its place is taken by mercury vapor the terminals of an alternating circuit are introduced. It has been found that at the negative electrode in the bulb there is a high reluctance to the passage of current, but there is practically no such reluctance at the positive electrode. But once the reluctance is broken down at the negative terminal, the passage of current takes place with a very little loss. Current cannot flow in the opposite direction because the positive electrode would then become negative and would offer a high reluctance until overcome by special means. One form of the rectifier is to use three positive electrodes, one for each phase of a three-phase circuit, and one negative electrode. As the three phases overlap, the negative electrode must always be negative to one or other of the electrodes, so that once the rectifier is started it will continue to run, using only the impulse in one direction. By this means a direct current may be taken off the negative electrode, which will be slightly pulsating though not as much so as the pulsating current produced by the commutator of a direct current dynamo. There are other ways of operating the rectifier, so that it may be used with a single phase alternating current. An auxiliary current may be used to keep the path through the negative electrode open or the reluctance at one electrode may be made far greater than the reluctance at the other. The reluctance at the negative electrode varies inversely as the density of the vapor. The density, on the other hand, depends upon the heat generated within the rectifier. In order, then, to pass a heavy current at high voltage through the rectifier means must be provided for keeping its temperature down so that the density will be reduced sufficiently to prevent reverse currents from breaking through the vapor.

In the experiments conducted for Mr. Hewitt by the Westinghouse Company in Pittsburgh, metallic vessels were used in place of glass bulbs, and means were provided for dissipating the heat by the use of circulating fluids such as oil or water. The heat produced was practically proportional to the current and not to the square of the current, as in other electrical devices. In small rectifiers the loss is much greater than in the large apparatus. For instance, if 500 volts are passed through the rectifier, the voltage of the direct current side will amount to 484 to 485 volts, or a drop of 15 to 16 volts, so that the apparatus gives an efficiency of nearly 97 per cent. With a more powerful current the loss would be even less.

The simplicity of this apparatus, together with its efficiency, promises for it a wide range of usefulness. If it proves commercially practical, it will dispose of one of the most expensive pieces of apparatus required in the electrification of railroads. Alternating current of high voltage may be transmitted to a railroad from any desired place and reduced to a working voltage and then be rectified so that simple direct current motors may be used for propelling the trains. The transporting and rectifying apparatus would operate without attention in small stations about five miles apart along the line or if desired they could be used directly upon the electric locomotives, which would gather their alternating current at transmission pressure and convert it to direct current of low service voltage.

One of the "Ten Stories"

[*Many of our readers have doubtless heard of the "Ten Stories," a little book containing true narratives of scientific events in which the* SCIENTIFIC AMERICAN *played a predominant part. It has been quite impossible to meet the demand for the "Ten Stories." Accordingly, they will be republished, one at a time, in these columns, for the benefit of those readers who were unable to obtain a copy of the original booklet.*—EDITOR.]

The Sinking of the "Petropavlovsk"

MUCH of the slaughter that marked the siege of Port Arthur centered about the capture of what was known as 203-meter hill. The Japanese wanted that eminence, not to plant guns on it, but to observe the position of the Russian war ships anchored in Port Arthur harbor. Before the capture of the hill the Japanese fired into the town and the harbor with an alarming and puzzling accuracy, although the gunners never saw their target.

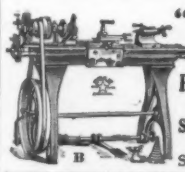
After a time the Russians discovered that a Chinese fisherman was particularly fond of a certain spot in the harbor. They watched him. If a shot fell beyond a particular ship he moved his boat in a corresponding direction. If a shot fell to the left, the simple Chinese found the fishing better in that direction. Apparently he had no mission in the world except to find the best fishing ground. Finally it dawned upon the Russians that his movements could be observed by Japanese field glasses. Fishing in the harbor was prohibited, and the Japanese fire went wide.

After a time the shots began hitting their marks with the former accuracy. The Russians looked for Chinamen. They found one. He liked to wade into the shallow water, apparently looking for crabs. He had a white bucket and a black one. If a shot fell short or went beyond the mark the white bucket moved in sympathy. If it went to the right or left, the black bucket was affected only. If a hit was made the buckets came together.

Possibly it was by using the simple Chinese that the Japanese succeeded in mining the entrance to Port Arthur harbor. On April 13th, 1904, Admiral Makaroff came out at the head of his fleet, his pennant flying from the "Petropavlovsk." The flagship struck a cable that connected three floating mines. One mine swung to port, two to starboard. In a few minutes Makaroff and his ship went down. The fleet turned and fled into port.

Two months later the SCIENTIFIC AMERICAN received an official letter from St. Petersburg. It ran:

"It will no longer be necessary to send the SCIENTIFIC AMERICAN to the officers of the wardroom mess of His Imperial Majesty's battleship "Petropavlovsk."



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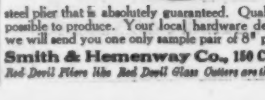

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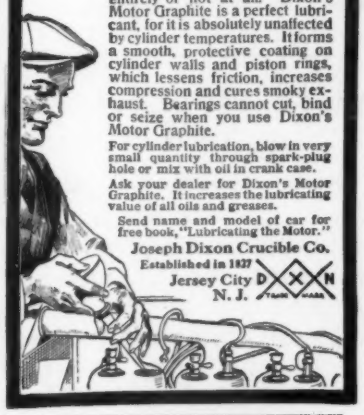

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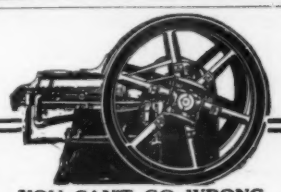

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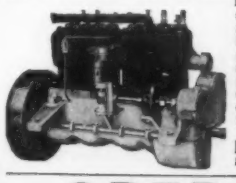

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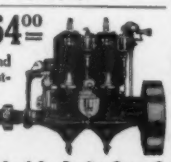

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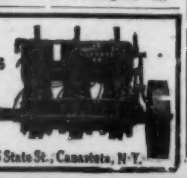

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NEW BOOKS, ETC.

ALCHEMY, ANCIENT AND MODERN. By H. Stanley Redgrove. London: William Rider & Son, Ltd., 1911. 141 pp.

Although there is very little connection between what may be termed modern alchemy, that is, the alleged transmutation which seems to have been brought about by radioactive substances, and medieval alchemy, still the author of this book has written a very instructive and entertaining book, in which he has ingeniously linked ancient and modern conceptions of matter. He himself writes: "Correctly speaking, there is no such thing as modern alchemy;" and thereby sets the reader right. What is to be commended in the author's presentation is his sympathetic treatment of the old-time alchemist. He regards him as part embryonic chemist and part mystic, and seeks to do justice to this duality by interpreting the alchemist's work accordingly. The chapter headings read as follows: I, The Meaning of Alchemy; II, The Theory of Physical Alchemy; III, The Alchemists. (*A*. Before Paracelsus); IV, The Alchemists. (*B*. Paracelsus and After); V, The Outcome of Alchemy. VI, The Age of Modern Chemistry. VII, Modern Alchemy.

FAMOUS SEA FIGHTS FROM SALAMIS TO TSUSHIMA. By John Richard Hale. Boston: Little, Brown & Co., 1911.

The great Francis Bacon understood, even in his remote day, the value of sea power, when he wrote: "There be many examples where sea fights have been final to the war. But this much is certain, that he that commands the sea is at great liberty, and may take as much and as little of the war as he will. Whereas those that be strongest by land are many times nevertheless in great straits." The author of "Famous Sea Fights" tells in non-technical, popular language, the story of some of the most remarkable episodes in the history of sea power. He begins with the first sea fight of which we have a detailed history, the battle of Salamis, B. C. 480, and ends with the last, and what he justly designates as the greatest naval engagement, the battle of Tsushima. Naturally, the story of British victories occupies a large section of the work, and he gives an account of British triumphs on the sea from Sluys to Trafalgar; but the work includes instances from the history of other countries also, the author realizing that the skill, enterprise, and courage of admirals and seamen is no exclusive possession of the British people. The book incidentally describes the evolution of the warship, from the wooden galleys that fought in the Straits of Salamis to the steel-built, steam-driven giants that met in the Straits of Tsushima. The work also gives some interesting side-lights on the ways of seafaring men of old. The book is divided into three parts; first, the period of oar and close fighting; second, the period of sail and gun; and third, the period of steel armament and rifle artillery.

A SHORT COURSE IN THE TESTING OF ELECTRICAL MACHINERY. For non-electrical students. By J. H. Morecraft, Assistant Professor of Electrical Engineering, Columbia University, and F. W. Hehre, Instructor in Electrical Engineering, Columbia University. New York: Van Nostrand & Co., 1911. 154 pp. Price, $1.50.

This book is intended for the use of students in mining, mechanical, metallurgical, chemical, and civil engineering, who are unable to devote very much time to the study of electricity, but who nevertheless must be familiar with some of the most essential principles and methods used in handling and testing electrical apparatus and machinery. With this end in view a number of typical experiments have been collected, just so much of electrical theory being given in each case in the text as is absolutely essential to the proper understanding of the work. The scope of the book is shown by the following list of the experiments covered: I. *Direct Current Experiments.* "Fall of Potential" along a conductor carrying current. Measurements of armature circuit and shunt field resistances. The shunt generator; preliminary work with a generator; magnetization curve; external characteristic. The compound generator; armature characteristic of a shunt generator; external characteristic of a compound generator; effect of operating a compound generator at speeds higher or lower than rated value. The shunt motor; speed characteristics; commercial efficiency by brake test. The motor starting rheostat. Shunt motor efficiency by the stray power method. The series motor. Current torque curves of different types of motors. Parallel operation of shunt generators. Parallel operation of compound generators. II. *Alternating Current Experiments.* Wave shape, power and power factor, effective values. Properties of the A. C. circuit. The alternator; its characteristics on non-inductive and inductive load; prediction of external characteristics. The transformer; operation and characteristic curves; measurement of losses and production of efficiency. The induction motor; its operating characteristics with and without added rotor resistances. The synchronous motor; synchronizing and phase characteristics. The rotary converter; effect of speed and voltage upon ratio; operating characteristics. Parallel operation of alternators; distribution of load; circulating current, etc. Three-phase circuits; current and voltage relations; measurement of power. A book of this kind fulfills a well-defined function, and should prove useful for just the class of students for which it is intended. The experiments seem well chosen and the treatment is concise and clear.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12617) H. I. B. asks: Will you kindly tell me if there is any inflammable liquid that will ignite potassium (metallic)? Have tried a number of different kinds, but have not succeeded, although I was told that either benzine or ether would ignite it. A. Potassium is a metal, and will not ignite and burn except it be heated to the proper temperature. It will not burn when cold any better than any other metal. The way to set it on fire is to drop it into water. The water is decomposed by the rapid oxidation of the potassium, and the heat produced ignites the hydrogen of the water and hastens the action. Some of the potassium is vaporized and gives the characteristic color to the flame, which would otherwise be a blue flame from the burning hydrogen. Potassium is not easily ignited even when held directly in the flame of a Bunsen burner.

(12618) C. A. R. asks: Is the Mississippi River higher at its mouth than it is at its source? If so, how much higher, and the cause? A. The Mississippi River is farther from the center of the earth at its mouth than it is at its source. This is because the radius of the earth at the equator is 13 miles longer than at the poles. The reason for this is the rapid rotation of the earth on its axis. The velocity is 1,000 miles an hour at the equator. When the earth was plastic it assumed this form, bulging out at the equator. Upon cooling it retained the same shape. The water of the ocean has the same form. A water level is 13 miles farther from the center of the earth at the equator than at the poles. In order for water to flow down toward the south, the water at the north must be farther from the center of the earth than the water level would require it to be. The Mississippi River flows down hill all the way from the source to its mouth, which means that the source is higher above a water level, which is sea level, than the mouth is. Water does not anywhere on the earth run up hill, nor along a water level. It only can run from a higher level to a lower level.

(12619) A. A. A. asks: In watching the films in a moving picture, I have noticed that the wheels of an automobile appear to be turning in the opposite direction from that of the machine. Can you explain this optical illusion? A. In taking a moving picture of an automobile in motion, the wheels will appear to be at rest or to turn forward or backward, according as the interruptions of motion of the film are at the same or a different speed to the motion of the spokes of the wheel.

(12620) C. L. A. asks: On Sunday evening, March 3rd, just after the full moon was up, there appeared at about fifteen degrees to the south of it the strangest and most beautiful sight—what would be usually termed in daytime a sun-dog—that has ever been witnessed in these parts. Many persons' attention was called to it, and all remarked they had never seen nor heard of such a thing before. The rainbow colors were particularly bright and distinct, while apparently glancing from them on the side opposite to the moon, southerly side, were bright yellow rays, which finally became dimmer and appeared like the tail of Halley's comet for about an hour after the spectrum colors had left off. Is this a matter of common occurrence, and what causes it? A. The unusual feature of the lunar halo which you describe is the brightness of the colors of the spectrum seen in it. We have had several letters describing it, and thank you for calling attention to the interesting phenomenon.

(12621) H. H. asks: Recently the question was raised as to which wheels left the ground when an automobile was going around a curve at a high rate of speed. I stoutly held to the fact that the inside wheels left the ground. I gave my friend some simple facts as to why I thought the inside wheels left, but they were insufficient to convince him. Will you kindly give me an explanation that you think ought to convince him? A. When an automobile overturns in rounding a corner by reason of too high speed, the inner wheels leave the ground first. Anyone who has felt himself pressed to the outer side of the curve while riding in a car ought to realize this fact. A study of the action of centrifugal force in any text-book of physics will be still further helpful in understanding it. All riders of horses and bicycles lean in when rounding a curve, in order to prevent being thrown outward from the horse or wheel. Circus riders often lean far in, as you doubtless have seen, in going swiftly around the ring. If they did not, they would be thrown far out. They lean in till they feel in equilibrium, as if they were standing upright at rest.

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Domestic Engineering

April Magazine Number of the Scientific American. Issue of April 13th, 1912

¶ There is an experiment station at Colonia, New Jersey, where domestic engineering is being studied scientifically. Here are tested all manner of labor-saving devices, from the vacuum cleaner to the garbage incinerator, from the raisin-pitter to the floor scrubber. Every appliance that aims to relieve the drudgery of housework is put on trial and its worth in actual practice is critically and impartially judged. Mary Pattison, under whose direction the tests are conducted for the New Jersey State Federation of Women's Clubs, is a disciple of Frederick W. Taylor, the well-known efficiency engineer. She is going to tell of her interesting work in the April Magazine Number.

¶ Waste of any sort, whether of material, time or energy, is inexcusable except on the ground of ignorance. Frank B. Gilbreth's book on "Motion Study" shows how the efficiency of brick-layers was increased by eliminating needless efforts. But the principles he outlined are applicable to every branch of human activity, and he is going to explain to the readers of the Scientific American how motion study may be used to lighten the task of housekeeping.

¶ One of the most serious problems presented by the detached villa or farm [illegible] disposal of sewage. The problem is more complicated [illegible] but methods have been developed for the complete purification of the sewage, and its filtration, so that the sewage water may be employed in the cultivation of the garden. This subject will be treated by Dr. Jacolyn Van Vliet Manning.

¶ In addition to these articles the Number will contain the usual variety of material including an article by C. H. Claudy on the Woman Inventor.

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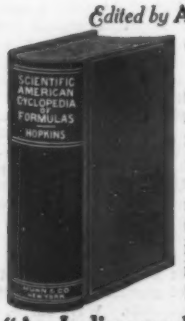

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